FLIGHT
and The AIRCRAFT ENGINEER

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The Outlook

The Norway Campaign

THE new development, the unscrupulous invasion of Denmark and Norway by Germany, has not yet changed the main character of the war. A land campaign is certainly developing in Norway, but the opening stages of the invasion were simply an extension of the sea war which has been in progress since last September. And, as from the start, air power has been faithfully co-operating with sea power.

It is not easy to fathom what ideas have been working in the minds of the German High Command. An invasion has been started by landing troops at various points on the Norwegian coast, although Germany did not command the seas. The German Navy, hitherto snugly ensconced in the harbours in the neighbourhood of the Keil Canal, has been sent out into the open. It was not sent as one compact force which might have caused some little trouble to the British Fleet, but was divided and sub-divided to support the various landings in a way which must have caused joyful surprise to My Lords of the Admiralty.

One can imagine Sir Dudley Pound exclaiming, in the words of Cromwell before the battle of Dunbar, "The Lord has delivered them into our hands." For the last few days the Royal Navy has been zestfully engaged in sinking and crippling units of the German Fleet along the eastern shores of the North Sea, in obtaining mastery of the Skagerrak and Kattegat, and in laying a stupendous mine-field which ensures that no German ships which are at sea have any chance of regaining a German port. The corridors of neutral waters along the coasts of Denmark and Norway have ceased to be neutral, and are open to the operations of the Royal Navy. No more iron ore from Sweden can reach Germany from the port of Narvik. No more reinforcements or supplies can reach the German troops in Norway from the sea. In short, German sea power, such as it was, has almost ceased to exist.

The Possible Alternative

IT really seems that Hitler has been indulging in what chess players call a gambit, sacrificing a pawn in the hopes of gaining a position which may work out to his advantage. In this case the German Navy has played the part of the pawn. It has been recklessly, though deliberately, thrown away. One can hardly imagine that Admiral Raeder willingly consented to such a sacrifice, but he may have been over-ruled either by Hitler in a mad frenzy or by strategical arguments advanced by Field Marshal Göring and General Brauchitsch. It seems as if they believed the German Navy incapable of contributing to ultimate victory, and therefore decided to sacrifice it. Parties of troops landed at points on a hostile coast may hurriedly seize a post of importance, but they cannot maintain themselves for long unless they receive supplies and reinforcements. These will certainly not come by sea, and most probably an attempt is being made to send them by air. Perhaps this was one of the reasons for including Denmark in the new movement.

Aalborg aerodrome, on the Limfjord in the north of Denmark, may be the key to these plans. The town is connected with Germany by good railways and roads, and troops can be massed there without the use of the sea or any great expenditure of petrol. From there it is but a relatively short flight to aerodromes in Norway, and a map which we publish on another page shows where these aerodromes are situated. Almost any sort of ancient bomber or commercial aeroplane can be used for sending troops across to Norway, and they could be escorted by fighters on the way. Each transport aircraft could make several trips a day, and so it should be possible to pour some thousands of German soldiers into Norway in a very short time. These troops could take machine guns with them, and the cargoes could include large supplies of ammunition and also plenty of rations—though the Germans in Norway

most probably have been instructed to "live on the country." The Norwegian farmers have our sympathy, for the payment given for their flocks and herds is likely to be in German paper money the value of which is problematical.

Its Drawbacks

THERE are, however, drawbacks to this scheme, neat though it looks at first sight. Infantry with rifles and machine guns may suffice for the moment to deal with the Norwegian Army, which had to undertake mobilisation after the invasion had begun. But, if more serious opposition has to be encountered by the invaders, machine guns will not suffice. Aircraft cannot convey *all* the heavy impedimenta and weapons of a modern Army. Heavy guns, tanks, lorries, and numerous other necessary adjuncts to modern warfare can certainly not travel by air.

With Allied command of the sea, the landing of an Anglo-French expeditionary force is possible at chosen points on the Norwegian coast unless German aircraft can prevent it. It has been held that such a landing is impossible in the face of a strong bomber force, and we must suppose that the *Luftwaffe* will not be so supine in Norway as it was while the B.E.F. and the Air Force landed in France.

Another consideration is that Aalborg aerodrome can itself be bombed, and if our bombers can defy the defences which will certainly have been prepared, the reinforcing of the German troops in Norway in that way will not be a simple matter. Hitherto our experience has not been that German anti-aircraft guns can prevent our bombers from carrying out their purpose. We must wait to see what will happen.

THIRTEEN YEARS AGO. In 1927 a number of British flying boats paid a visit to Scandinavia. They included a Supermarine Southampton, and this photograph shows Sir Samuel Hoare, Air Minister then as now, in the Southampton in which he returned from Copenhagen. A history of the Supermarine firm is published in this issue.

The Loss of H.M.S. Gurkha

WE must lament the loss of the Tribal class destroyer H.M.S. *Gurkha*, though all but fourteen of her company were rescued. The Tribal class destroyers are splendid ships, and the *Cossack* has twice distinguished herself, once by cutting out the *Altmark*, and since then by knocking out a howitzer in the second battle of Narvik.

The really notable point about the loss of the *Gurkha* is that we believe her to have been the first warship on either side which has been sunk by air bombing when she was at sea and moving. She was attacked over and over again by German bombers, and after she had been fatally hit she kept afloat for four and a half hours. With the bulldog gallantry of the Royal Navy, she fought her anti-aircraft guns until her decks were almost awash. Certainly she was no easy victim for the German bombers.

This incident provides food for thought. During the past years of peace there have been not a few wrong-headed enthusiasts in this country and elsewhere who seriously believed that air bombs would master the fleets of their opponents. If that theory had been proved correct, let us imagine what an advantage it would have conferred on Germany in this war. If the British Fleet had been driven off the seas by the bombers of the *Luftwaffe*, where would the Allies stand now? What chances would Norway, Denmark and indeed Sweden have of surviving this war as independent nations? What hopes would there be of the renaissance of Austria, Poland and Czechoslovakia? What would be the future of Britain and France?

But, after seven months of war, one moving warship has been sunk by air bombs. However enthusiastic we may be about aircraft, let us all offer up humble thanks for this particular failure of the bomber.

Refuelling in the Air

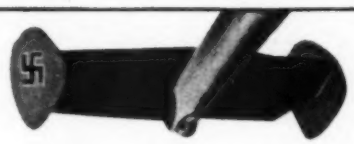
WE have been privileged to hear a most interesting and valuable lecture at the Royal Aeronautical Society by Sir Alan Cobham and Mr. Marcus Langley on that work which has been occupying their attention for some time—refuelling in the air. While developments on this subject are perhaps not absolutely complete, the paper shows conclusively that a very great amount of progress has been achieved.

The champions of this method have not only devoted their efforts to perfecting the drill and the mechanical devices necessary for transfer of fuel, in itself a big work, but also to theoretical work which provides the necessary basis for evaluating just what are the limits of the obvious advantages which refuelling bestows on long-range aircraft. They have now reached the stage at which, to realise the advantages to the full, an aeroplane, specifically designed for refuelling, should be built. Present craft are not structurally adequate to carry loads equivalent to about 60 lb. per sq. ft. of wing area, the loading which theory indicates is about the optimum, and which could be carried if much of the fuel load were added after climbing to a safe height.

The lecturers also pointed out that their method may allow the advantages of the compression-ignition engine to be utilised fully, as refuelling in the air eliminates the necessity for the great temporary output of power called for during the take-off, which the compression-ignition engine has not been able to supply.

Although the Me 110 was originally designed as a multi-purpose type, and first produced as a fighter, the new modified bomber version is not to be despised. This picture shows how the bombs are carried.

THE LUFTWAFFE



Its Inception, Organisation, Disposition, Training and Equipment

THE men of the *Luftwaffe* may perhaps rejoice at the extension of the war to Scandinavia for there they will have a chance of co-operating with the ground forces of the Army of which they are a part. We have all heard much of the terror inspired in many parts of Europe by the size of the *Luftwaffe*, and it is certainly probable that the Nazi chiefs had this terrifying aspect of their air arm in mind when they decided to swell it to really large proportions. Still, they do not seem to have contemplated using it for an independent air campaign, and they almost certainly did not prepare it for a war with Great Britain. The *Luftwaffe* was trained to co-operate with ground troops, and the sort of campaign for which it was prepared was that fought in Poland, when the German aircraft worked with the mechanised ground troops with great success. Independent action over the sea was not apparently foreshadowed, and the need for undertaking it when Britain instituted a sea war with Germany must have come as a rather unwelcome surprise to the German air crews. They have been ready enough to bomb cities, and also fugitive civilians, but in Poland all that was done in co-operation with the ground troops. The idea of beating an opponent to his knees by massed bombardment of cities without any corresponding invasion by ground does not seem to have been in the minds of the founders of the *Luftwaffe*. Perhaps that is partly the reason why no air action was taken against the cities of Britain and France in the first seven months of war, though, of course, there probably were other considerations as well.

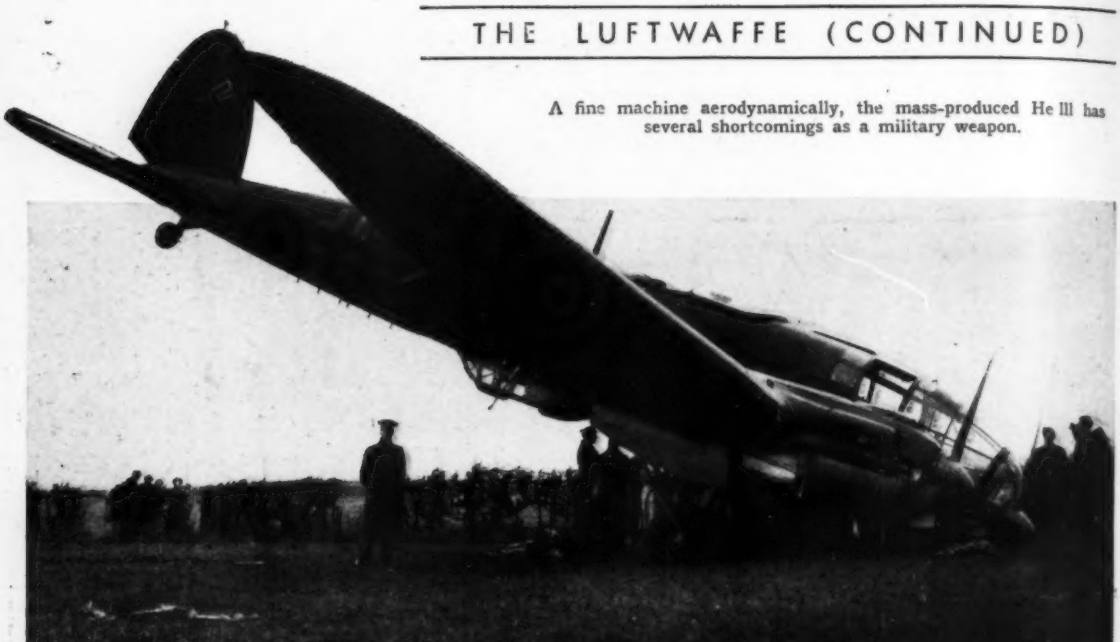
In 1932 Hitler appointed Göring as Commissioner in charge of all flying in Germany, and at once the latter planned an enormous scheme of air expansion. Right at the beginning he began to build a very large Air Ministry (the word is not quite correct, as there is no independent Air Force in Germany) in Berlin. Its size provoked some mirth and sarcasm among Germans as well as among foreign observers, but the original plan proved not large enough, and lately the building has been enlarged. All industry was mobilised to aid in the production of vast numbers of aircraft and aero engines. The factories were situated in the eastern part of the country, so as to be farther away from the French frontier; evidently Russia was never regarded as a possible enemy. The training schools are also situated in the east. The factories were designed with three main objects: mass production, camouflage, and comfort of the workers. Each factory has its own school for apprentices.

Standardising Types

By September, 1935, things had advanced so far that twenty-four squadrons were allowed to appear and to take part in manœuvres. At the same time the world first saw the original civil versions of the Ju 86 and the He 111. In 1937 the latter machine and the Me 109 began to appear in great numbers in the squadrons.

In setting about his expansion Göring had to make an early decision on the types which were to be standardised for mass production. He decided on one fighter and one bomber, the Me 109 and the He 111. There had been a competition for the fighter, and the Heinkel firm had produced the He 112. But there was need for the Heinkel firm to devote all its energies to turning out the standard bomber and so the Messerschmitt fighter was preferred. That was in 1935, and at that time the Me 109 was certainly the best fighter in any air Ser-

THE LUFTWAFFE (CONTINUED)



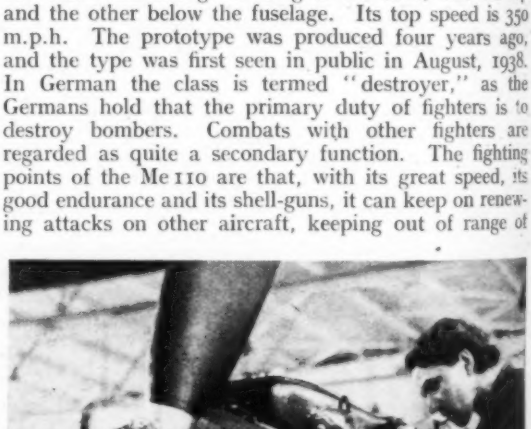
A fine machine aerodynamically, the mass-produced He 111 has several shortcomings as a military weapon.

vice in the world. But at the time there was no reliable engine giving 1,000 horsepower and so the 109 was designed for a unit of less power. Afterwards it was modified to take the more powerful engine, with the result that the machine became over-engined and its manœuvrability suffered. For its day, the armament of the Me 109 was formidable. It can use either four machine-guns or shell-guns. The choice of its armament seems to be made by the commandant of the station from which the *staffel* operates. A battery of eight machine guns was not then contemplated.

The Best Bomber of its Day

The He 111 was also the best bomber of its time when it was designed. It was designed before our Blenheim, and it was faster than our then fastest fighter, the Fury. No wonder Göring thought he had chosen wisely when he put this type into production. The He 111, and also its replacement, the Ju 88, exemplified the deliberate German policy about bombers. Load and speed were thought the main desiderata; armament was considered of very minor importance. The soundness of this policy seemed to be confirmed by the lessons of the Spanish civil war. Unfortunately for the Germans, designers like Mr. Camm and the late Mr. Mitchell can upset the best-laid scheme of mice and Nazis. The appearance of the ultra-fast Hurricane and Spitfire with their eight machine-guns put the He 111 into the category of has-beens. Against our fighters the Heinkel could not hold its own in combat, nor could it escape from their pursuit in a clear sky. It was reduced to hanging about near the protection of clouds, and hurrying into them as soon as British fighters were sighted. Its period of active service was limited to the first winter of the war, when the sky was mostly cloudy; and when the spring came the German pilots must have been very glad that a replacement bomber was ready to make its appearance.

Though committed to the mass production of one fighter type and one bomber type, both of which proved failures in the first months of the war, Göring had been prudent enough to make arrangements for replacements. These new types have lately been taking a fairly prominent part in air operations. As the readers of *Flight* know, they are the Messerschmitt 110 fighters and the Junkers 88 bomber. Our readers also know that the Me 110 is a two-seater twin-engined fighter armed with two shell-guns and two machine-guns firing forward and two other machine-guns firing to the rear, one on top and the other below the fuselage. Its top speed is 350 m.p.h. The prototype was produced four years ago, and the type was first seen in public in August, 1938. In German the class is termed "destroyer," as the Germans hold that the primary duty of fighters is to destroy bombers. Combats with other fighters are regarded as quite a secondary function. The fighting points of the Me 110 are that, with its great speed, its good endurance and its shell-guns, it can keep on renewing attacks on other aircraft, keeping out of range of



The nose of the Me 109 showing the hole in the spinner for an engine-mounted shell-gun.

AIR YOUR KNOWLEDGE

1 What German aircraft is nicknamed the "Flying Pencil" ?

2 Who made the first non-stop flight from New York to Berlin ?

3 If you saw an aircraft bearing registration letters starting SX, to what country would it belong ?

4 What aircraft of the R.A.F. was nicknamed "Harry Tate" ?

5 What is "aspect ratio" ?

6 What is an ornithopter ?

7 What type of airscrew is fitted to the latest Hawker Hurricanes ?

8 What is skin friction ?

9 Who won the £10,000 "Daily Mail" prize for a flight from London to Manchester in 1910 ?

10 Has geodetic construction been used for any aircraft other than the Wellesley and Wellington ?

11 At what figure does the world's absolute speed record stand ?

12 Which British fighter accounted for the greatest number of enemy aircraft in the war 1914-1918 ?

The answers to these questions will be found on page 367.

What is the object illustrated below ?

THE LUFTWAFFE (CONTINUED)

machine-gun fire while using its shell-guns, or closing in with machine-guns, as the captain thinks fit. It is believed to have been used in Poland as an escort for bombers, and it might be able to escort them from Germany to certain parts of the coast of England, but if it had to open its throttles to fight it would have a dubious margin of petrol for the return flight. As a home-defence fighter it must be considered a very good design. Some specimens have been adapted to carry bombs, and the machine should make a useful bomber for certain work.

Load and Speed

The Junkers 88 follows the main specification of its predecessor, the He lll. That is to say, the designer has concentrated on load and speed. Most parts of the British Isles are within its range, and it can muster a top speed of 300 m.p.h., cruising at about 260. It is capable of dive-bombing. It has not yet been provided with protective armour, and its armament consists of one machine-gun firing forward and two to the rear. If intercepted by our fighters it should be no harder to destroy than was the He lll. As all the German factories have been equipped to turn out machines which have a slim fuselage, it seems almost impossible that our enemy should be able to turn over to power-operated gun turrets in their bombers. So it seems that that tremendous asset of our bombers will probably remain an advantage of the R.A.F., at least for some time to come.

The operational stations of the *Luftwaffe* are mostly in Western Germany. There are great numbers of aerodromes, and at least 500 of them are permanently manned and ready for use. Its mobility is one of the great points about the *Luftwaffe*. It is organised in *Geschwader*, corresponding roughly to our R.A.F. Groups; *Gruppen*, which have about the same strength as R.A.F. stations, and *Staffeln*, or squadrons of about a dozen machines each. The *Geschwader* move freely and rapidly about the country, accompanied by freight-carrying aircraft, and so the German bomber forces may be massed one day near the Swiss frontier and then in a short time be transferred to the frontiers of Holland or to the shores of the North Sea. The bomber crews have been well trained in night work, but there has been comparatively little night flying by fighters.

As for the personnel of the *Luftwaffe*, the force is a mushroom growth, and there must be a shortage of trained staff officers and also of instructors. The casualties in the training schools have been very much heavier than with us. There has been no lack of volunteers for the flying side, though a certain number of the mechanics have been brought in under the conscription system. The air crews are mostly composed of young men who have been carefully nursed in the Nazi doctrine. They have probably been taught that they, as a Force, are invincible, that Germany is impregnable, and that the Royal Air Force is contemptible. Their own casualty lists are given very little prominence, while German successes, or alleged successes (e.g., sinking the *Ark Royal*) are loudly broadcast. Those units which have been much engaged over the North Sea must have learnt something of the truth, as they have lost over 50 aircraft for one Spitfire destroyed and two British fighter pilots wounded. But the number of aircraft employed over the sea has not been large, and so the truth may not have spread widely among the air crews of the *Luftwaffe*. Perhaps more of them will learn the truth in Norway.

Still Good

"*Jane's All the World's Aircraft, 1939.*" *Compiled and Edited by C. G. Grey and Leonard Bridgman; 42s. Sampson Low, Marston and Co., Ltd., 100, Southwark Street, S.E.1.*

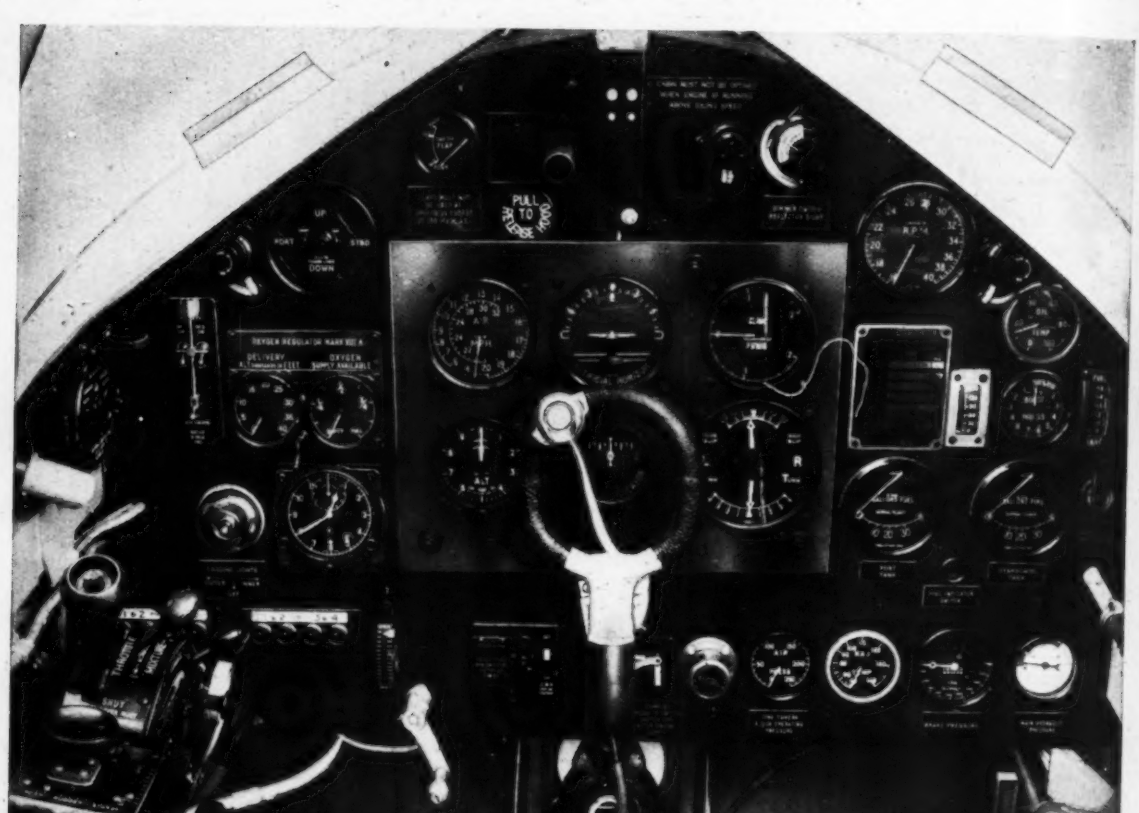
"JANE'S" has again been produced under difficulties, but contrives to make a good showing, although slightly reduced in bulk.

It was to be expected that the British, French and German sections would be somewhat abbreviated, but there are several omissions which are unjustified as the necessary data were certainly available at the time of production.

However, in spite of these gaps and a number of errors, "Jane's" still ranks as the leading annual work of reference on aeronautics.

FLYING the MASTER

How Aerobatics Should be Carried Out.

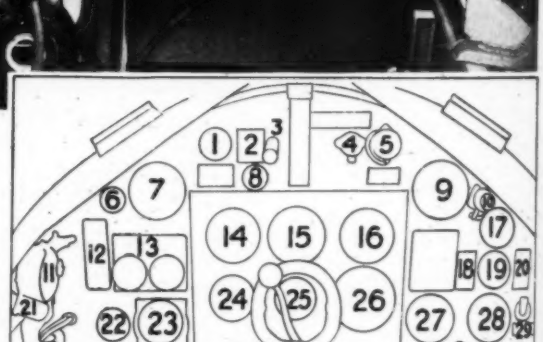


THE fact that Phillips and Powis Aircraft, Ltd., have issued some *Pilots' Notes* for the Miles Master has already been recorded in *Flight*. The book is particularly valuable as it includes detailed information on aerobatic procedure.

It is important to remember that the Master has deliberately been given a high wing-loading (actually it is about the same as that of the Spitfire) and must accordingly be treated with the same respect as modern fighters.

An interesting check on this high stalling speed with the control column pulled back too much is to dive the Master to 240 m.p.h. I.A.S. and to start a loop by easing the control column back fairly rapidly. It will be noticed, as the aircraft approaches the vertical, that it will give a sharp flick and roll out of the loop. This flick gives ample warning and if the pressure on the control column is eased just before the flick occurs it will be quite easy to continue a perfectly straight loop.

The correct procedure for looping is to trim the aircraft slightly tail heavy, ease the throttle back and put the machine into a gentle dive up to about 220 m.p.h. I.A.S. Pressure on the control column will tend to build up, and on reaching 220 m.p.h. the pressure on the stick should be released. As the nose rises above the horizon the throttle should be opened to the gate position, and as the pressure disappears the stick should be eased back



INSTRUMENT BOARD.

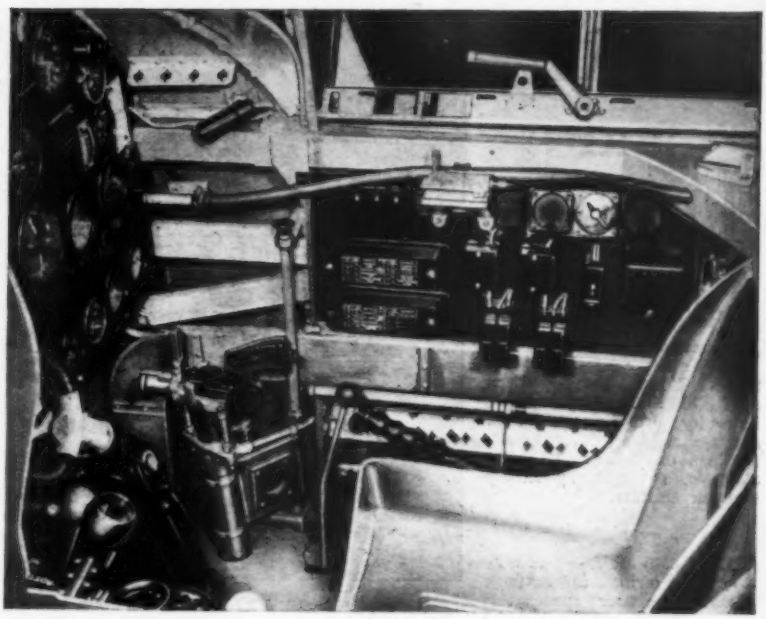
1, Flaps Position Indicator ; 2, Airspeed Indicator Correction Card ; 3, Speaking Tube Connection ; 4, Reflector Sight Lamp Socket ; 5, Reflector Sight Dimmer Switch ; 6, Cockpit Lamps Dimmer Switch (Port) ; 7, Undercarriage Position Indicator ; 8, Instrument Flying Hood Release ; 9, Engine Revolution Indicator ; 10, Cockpit Lamps Dimmer Switch (Starboard) ; 11, Signalling Switchbox ; 12, Main Magneto Switches and Undercarriage Indicator Switch ; 13, Oxygen Regulator ; 14, Airspeed Indicator ; 15, Artificial Horizon ; 16, Rate of Climb Indicator ; 17, Oil Temperature Thermometer ; 18, Oil Pressure Gauge ; 19, Boost Pressure Gauge ; 20, Fuel Pressure Gauge ; 21, Cockpit Lamp ; 22, Landing Lamps Switch ; 23, Time of Flight Cock ; 24, Altimeter ; 25, Directional Gyroscope ; 26, Turn and Bank Indicator ; 27, Fuel Contents Indicator (Port Tank) ; 28, Fuel Contents Indicator (Starboard Tank) ; 29, Fire Extinguisher Switch (under Flap) ; 30, Bomb Selector Switches ; 31, Radiator Flap Indicator ; 32, Bomb Jettison Switch ; 33, Oil Cock ; 34, Starting Magneto Switch ; 35, Engine Priming Pump ; 36, Pneumatic System Pressure Gauge ; 37, Radiator Temperature Gauge ; 38, Fuel Contents Indicator Switch ; 39, Brake Triple Pressure Gauge ; 40, Hydraulic System Pressure Gauge ; 41, Control Box ; 42, Radiator Flap Control ; 43, P.6 Compass.

gently to complete the loop. The rudder, of course, should be used to keep the aircraft straight.

A roll off the top of a loop should be started at 240 m.p.h. I.A.S. The same remarks apply as for loop during the initial stages. As the aircraft reaches the top of the loop ease the control column forward to the central position and hard over to one side. Stop the nose from dropping by use of rudder.

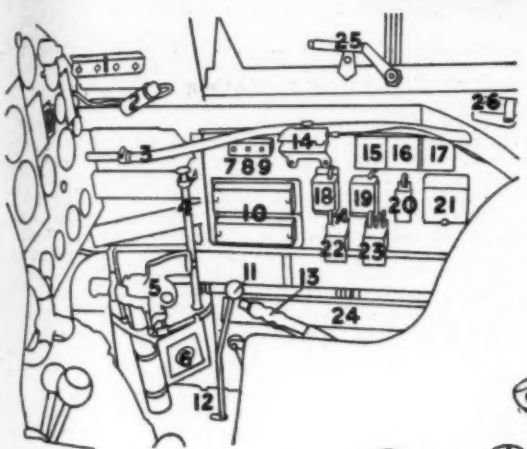
It is claimed that the Master slow rolls beautifully at any speed in excess of 160 m.p.h. I.A.S.; a climbing roll is executed at any speed over 220 m.p.h. I.A.S. It is recommended that only climbing half-rolls should be carried out owing to the height lost after rolling over into the inverted position.

The Master must be forced into a spin, for it will not go into one unless both controls are crossed. If the rudder is held central the aircraft will not spin. The best way of entering a spin is from a slow gliding turn with the nose of the aircraft well up. As



STARBOARD SIDE OF COCKPIT.

1, Stowage for Gun Reflector Sight Lamps; 2, Cockpit Lamp; 3, Fire Extinguisher Bayonet Connection; 4, Fuel Cock Control; 5, Signal Pistol in Mounting; 6, Cine-camera Gun Footage Indicator Mounting; 7, Navigation Lamps Switch; 8, Cine-camera Gun Switch; 9, Pitot Head Heating Switch; 10, Fuse Boxes; 11, Fuel System Priming Lever; 12, Rudder Bar Adjustment Lever; 13, Seat-operating Handle and Locking Plunger; 14, Safety Harness Release Gear; 15, Voltmeter; 16, Charge-regulating Switch; 17, Ammeter; 18, Fuse Boxes; 19, Fuse Boxes; 20, Resistance Unit; 21, Accumulator Cut-out; 22, Relay Switch; 23, Relay Switch; 24, Stowage for Signal Pistol Cartridges; 25, Emergency Door Handle; 26, Starting Handle Stowage.

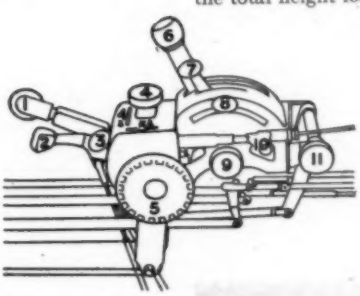


the aircraft approaches the stall, full rudder should be applied on the inside of the turn and the control column pulled hard back.

In the first half-turn of the spin the aircraft rolls on to its back, the nose falls and by the end of the first turn rises again above the horizon. During succeeding turns the nose gradually falls and the spin gets steeper and smoother. The spin is fully established by the end of the third turn. The angle of spin then remains constant at about 45 deg. to the horizon. The rate of rotation is slow and recovery is easy and straightforward.

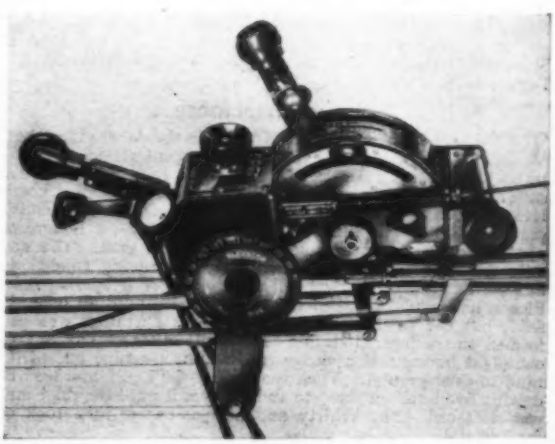
The instructions proceed: "To recover, apply full anti-spin rudder and ease the control column forward to the central position, but not farther forward because the elevators then tend to blank off the under surfaces of the rudder. As soon as rotation ceases, centralise the rudder and ease the aircraft out of the resultant dive. It is necessary to be quick centralising the rudder after rotation ceases in order to prevent the aircraft from going into the opposite spin. Should it do so, keep the control column still and apply full anti-spin rudder. Recovery is normal, although the spin produced is faster than a normal stick-back spin. Recovery from a left-hand spin takes about three-quarters of a turn longer than that from a right-hand spin.

"It will be noticed that considerable pressure is necessary to keep on full rudder in the spin, but that when applying full opposite rudder to recover from a left-hand spin the rudder has little effect for the first three-quarters of a turn, and then suddenly gets very powerful when recovery is almost instantaneous. In the right-hand spin, however, the rudder is immediately effective when applied 'anti-spin' and recovery is abnormally quick. Although the total height lost from entry to fully out of an eight-turn spin is only 5,500ft., it is recommended that spinning instruction should not be given under 10,000ft."

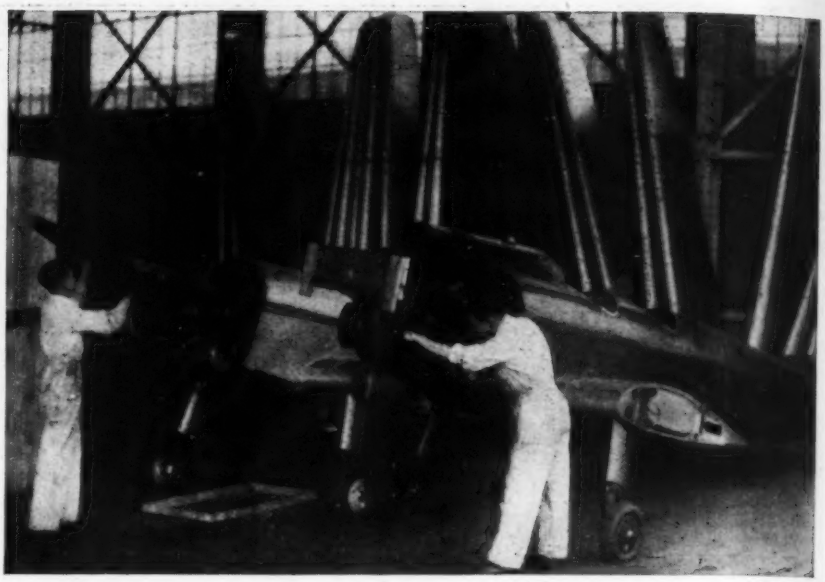


CONTROL BOX.

1, Undercarriage Selector Lever; 2, Flaps Selector Lever; 3, Landing Lamps Control Lever; 4, Rudder Trimming Tab Control; 4a, Rudder Trimming Tab Indicator; 5, Elevator Trimming Tabs Control; 5a, Elevator Trimming Tabs Indicator; 6, Throttle Control Lever and Bomb Firing Switch; 7, Mixture Control Lever; 8, Airscrew Pitch Control Lever; 9, Engine Controls Friction Adjuster; 10, Boost Control Cut-out; 11, Landing Lamps Control Friction Adjuster



HERE and THERE



MOTH MINORS AT MASCOT. A glimpse inside the De Havilland works. The wings in the background seem to promise large production in Australia.

"Moore-Brab."—P.P.S.

IT is announced (p. 358) that the new Air Minister, Sir Samuel Hoare, has appointed as his Parliamentary Private Secretary, Lt. Col. J. T. C. Moore-Brabazon, M.C., M.P. And so, once more, "Certificate No. 1" links up closely with air matters.

Next Week

READERS are asked to note that owing to extreme pressure on our space this week, caused mainly by the momentous events which have taken place in Scandinavia, it has been necessary to hold over our Correspondence page. We have a number of letters on hand concerning various subjects. These will be published in next week's issue. For the same reason it has been impossible to deal in this issue with Sir Alan Cobham's lecture to the R.Ae.S. on "Flight Refuelling." A summary will be given in the April 25 issue.

Cadets Want Officers

THE Ruislip-Northwood squadron of the Air Defence Cadet Corps ask us to call the attention of readers to the fact that two gentlemen are required to act as officers of the squadron. Ex-R.A.F. personnel capable of giving lectures would be particularly welcomed, and would find the work useful to themselves as well, as it would enable them to keep in touch with the R.A.F. Those interested should get into touch with Cadet Squadron-Leader Stead, 114, Ruislip-Northwood A.D.C., 4 M.U., R.A.F., Ruislip, Middlesex.

Measuring Night Visibility

A SPECIAL method of observation has been devised by the Indian Meteorological Department for measuring visibility at night for the information of airline pilots.

Until a few years ago, when flying was done mostly in daytime, visibility was estimated by fixing suitable landmarks at known distances from the observatory and in noting the most distant landmark visible. A similar method for night observations requiring lights of known candle power to be placed at specified distances up to two miles or more would involve serious practical difficulties.

But a simple and convenient method of determining visibility code figure at night with the help of a visibility meter and two lamps at small distances from the observatory has been found out as a result of experiments at Poona and is described in Scientific Note, Vol. VIII, No. 86, of the India Meteorological Department.

Aerial Ambulance

TYPICAL of the experiences of pilots in the Australian "outback" country is the story of the recent rescue of an injured man in central Queensland. An employee on a sheep station at Rockwood sustained injuries in a fall from a horse. Heavy floods after a storm had made it impossible for hospital parties to be sent to him. Mr. J. C. D. Whitty, a Longreach pilot, at once offered to take a doctor to the man. The 130-mile trip was short but in extremely bad flying conditions. Station hands had marked off a flat area for a landing field. Floods had made a bog of the surface, with mud all over the field, but the pilot made a landing. An operation was performed on the injured station hand while other employees took out eight horses and a sledge to drag the machine out of the mud to drier ground. Then the landing field was improved by driving five hundred sheep to and fro over it until the thick mud was flattened. Mr. Whitty and his passengers then took off for hospital.

Death of Captain Yancey

WE record with regret the death in New York, at the age of 44, of Capt. Lewis Yancey, the noted navigator and pilot. One of Yancey's latest big exploits was as one of the crew of the Consolidated PBY 2 *Guba* on the first aerial crossing of the Indian Ocean from Australia via Cocos, Chagos and the Seychelles to Mombasa. With Rogers and P. G. Taylor and others, Yancey brought the *Guba*, under charter to the Commonwealth of Australia, safely across this stretch of sea, the last of the oceans of the world to be crossed. Previous to this, he had been for about a year with the Archbold natural history expedition in New Guinea, to whom the boat belonged. It was in 1929 that Capt. Yancey first became famous for his flight from U.S. to Rome as co-pilot with Roger Q. Williams. One of the great and most modest men of the air has left us.

Rotol Flight Test Department

MR. L. B. GREENSTED has been appointed Chief Test Pilot, and Mr. J. S. Hall Assistant Test Pilot, to the newly formed Flight Test Department of Rotol Airscrews, Ltd., Cheltenham Road, Gloucester. Both are pilots of very considerable experience. They hold Second Class Navigators' and W/T. Operators' licences and have between them flown aircraft of type and size varying from a Chilton monoplane to a "C" class flying boat, and from a direct-control autogiro to an H.P.42.

They took the long Commercial Pilot's course at Air Service Training, Ltd., Hamble, in 1933. Mr. Greensted then instructed in Southern Rhodesia, and for three years has been on the instructional staff at Hamble. Mr. Hall has been with Jersey Airways, Ltd., and Imperial Airways, Ltd.

Building the ME 110

SOME neutral journalists have been shown round a factory which is building Messerschmitt Me 110 twin-engined fighters for the German Air Force. It was estimated that about 80 machines a month were being turned out and that 5,000 workers were employed, about 35 per cent. being women. In the main assembly shop—about 1,000ft. long and 400ft. wide—the visitors saw something like fifty machines under construction. A curious point was that groups of workers were doing all the work on one machine instead of having a specific job on each machine. It was said that all the materials used were German, but this is to be doubted.

The factory is situated on the borders of the Weiner-Neustadt aerodrome, about 50 km. south of Vienna and 15 km. from the Hungarian frontier, but, despite the fact that our Whitleys have been over Vienna, it is claimed that the factory is safe from air attack. Only machine guns are provided for defence. Actually, the works are composed of two old aircraft factories and the Austro-Daimler motor works, the area being about 2 sq. km., including the aerodrome. It was finished in July, 1938.

1912 TO 1940 (CONTINUED)

in some ways the greatest. It is true that Mr. Hubert Scott-Paine, whose energy had done so much to build up the firm, had resigned and had become a director of Imperial Airways via the British Marine Air Navigation Co., Ltd., but orders were beginning to come in on a fairly large scale, and Commander James Bird decided to turn his firm into a public company with a share capital of £300,000.

Metal Hulls

Events and developments followed at an amazing pace. The Southamptons had been giving excellent service, but the Air Ministry had decided to go over to all-metal construction, and Supermarines made a start by producing metal hulls for the Southampton, using the old composite wing structure. At that time comparatively little was known in this country about protecting duralumin against corrosion, and there was some speculation as to how these metal hulls would fare. Troubles there were, certainly, but in the main they stood up.

The great event of 1927, from the service point of view, was the flight of four Southampton flying boats to Australia, around Australia, and up to Singapore. The eastern cruise, as it was called, was under the command of Group Captain T. R. Cave-Brown-Cave, R.A.F. The flight started from Cattewater, Plymouth, on October 17, and on December 11, 1928, it finished at Singapore. One curious feature of the cruise was that it was found that barnacles would attach themselves to the black stripes with which the machines were painted for identification purposes. The white stripes they left severely alone. When the black paint was removed from the under-water portion of the hulls the nuisance ceased.

The eastern cruise of 27,000 miles was by no means the only meritorious flight of Southamptons. In 1927 many visits were paid to British coast resorts, and one Southampton took part in a flying boat cruise to Scandinavia, on which the then- and present-Secretary of State for Air, Sir Samuel Hoare, was one of the distinguished passengers.

In that year also the Australian Government ordered Southamptons for the Royal Australian Air Force, doubtless as a result of the good service being given by the Seagulls.

With so much work going on, the works at Woolston were becoming too small, and sheds at Hythe, erected by the Air Ministry during the war, were acquired as erecting sheds.

How it was done will ever be something of a mystery, but in 1927 the Supermarine works found time for designing and building machines for the Schneider Trophy Contest. The type was the S.5, with Napier Lion engine, and on one of these machines Flt. Lt. Webster won the race at Venice.

In the following year, 1928, Southampton flying boats were sold, in addition to those built for the R.A.F., to Japan and Argentina. A new type of boat was also produced, this time a three-engined version. The hull was like that of the Southampton. Originally it was intended as a torpedo-carrier for the Danish Navy, but it was never taken over by them, and was afterwards converted into a civil machine and sold to the Hon. A. E. Guinness, who used it as an air yacht. In its civil form this machine was known as the Solent. It was fitted with three Siddeley Jaguar engines.

Yet another milestone in Supermarine history was set up when, late in 1928, the firm was acquired by Vickers (Aviation), Ltd., thus becoming a member of that very powerful group of companies. The amalgamation did not, as so many feared, mean that Supermarines lost their individuality. The firm was permitted to continue its old policy of concentrating on marine aircraft, and many famous types have seen the light at Woolston since that time, all bearing the unmistakeable stamp of Mr. Mitchell's personality.

World's Records

The outstanding type produced in 1929 was the Schneider racer, type S.6. With a Rolls-Royce racing engine developing more than 2,000 h.p. one of these machines, piloted by Flying Officer Waghorn, won the Schneider contest at an average speed of 328.6 m.p.h. A few days later Squadron Leader Orlebar established world's speed records, first of 336.3 m.p.h. and afterwards at 357.7 m.p.h.

Another new type produced in 1929 was the Seamew, a three-seater amphibian flying boat fitted with two Siddeley Lynx engines. It was designed for reconnaissance duties, and in spite of the comparatively low power it had a speed of about 100 m.p.h.

A minor event, but one not without interest, was the alighting of a Southampton on Oulton Broad, and a successful start from that broad. So far as is known, that was the first time in history that a flying boat had operated from the broads.

Designed and built in 1929, the so-called Air Yacht made its first public appearance in 1930. This machine was a departure from previous Supermarine practice in that it was a parasol monoplane flying boat. Wing tip floats would have been difficult to mount, and so, instead, the hull was fitted with sponsons. On the leading edge of the wing three Siddeley geared Jaguar engines were mounted. The machine

The Seagull, Mark V, deck-landing amphibian with Bristol Pegasus engine has been bought in large numbers by the Australian Government. The R.A.F. version is known as the Walrus.

OUR FASTEST FIGHTER

A special *Flight* drawing showing features of the Supermarine Spitfire single-seater eight-gun fighter which is now capable of over 380 m.p.h. This high speed is combined with excellent manœuvrability thanks to the comparatively low wing-loading. The engine is a Rolls-Royce Merlin which gives 1,030 h.p. on 87 octane fuel and considerably more on 100 octane. Each of the eight guns fires at the rate of 1,200 rounds a minute.

The laterally retracting undercarriage of the Spitfire and the installation of the ducted radiator.

1912 TO 1940 (CONTINUED)

was built to the order of the Hon. A. E. Guinness, who had previously owned the Solent biplane boat. The hull was luxuriously fitted out for cruising over long distances, with sleeping accommodation and so forth.

In the way of service aviation new ground was broken by the introduction of a three-engined sesquiplane boat. This was known as the Southampton, Mark X, and was three-engined, with a sesquiplane super structure. The hull was flat-sided to facilitate production in metal, and an interesting feature was that the underwater portion of the hull was planked with stainless steel. The engines were Siddeley Jaguars.

During 1930 four Southamptons of the R.A.F. made a tour of the Baltic under the command of Group Captain E. R. C. Nanson.

An Unfinished Symphony

It was also during 1930 that most of the design work was done on a very large six-engined monoplane flying boat. This machine was to have luxurious accommodation for 40 passengers, and the estimated gross weight was to have been 75,000 lb. The engines chosen were of the Rolls-Royce H type, of 900 h.p. each. In addition to the design work, a considerable amount of actual construction had been done at Woolston, when the Government had one of its economy fits and cancelled the order. The machine was, therefore, never completed.

1931 will ever be most closely associated with the Supermarine firm, because in that year the Schneider Trophy contest was won outright by a S.6 B, and thus became the permanent property of Great Britain. In the contest the machine was piloted by Flt. Lt. Boothman at 340 m.p.h. average speed. Some time after the contest, another machine of the same type was flown by Flt. Lt. Stainforth over the speed course, and averaged 408.8 m.p.h.

During 1931 the Southampton Mark X was equipped with three Bristol Jupiter engines, which gave it a considerably better performance.

As an experiment, a Southampton was fitted with two Rolls-Royce Kestrels in place of the Napier Lions. The type did not go into production as such, but a year or so later, at first under the title Southampton Mark IV, a new version was produced, in which the Kestrels were placed under the top wing in order to give adequate airscrew clearance. Later on that machine went into production in considerable numbers for the R.A.F. under the name Scapa.

In 1932 the Supermarine drawing office got out the designs for a private-venture machine. This was a single-engined flying boat with a Bristol Pegasus engine driving a pusher airscrew. The machine was an amphibian, and ultimately went into production as the Seagull, Mark V. The design presented very considerable problems, as, in addition to being an amphibian flying boat, the machine was also intended to be suitable for catapulting. Much development work was done on the Seagull, and ultimately it was ordered by the Australian Government in considerable numbers, and also by the British Government. The R.A.F. name for it is the Walrus.

The Scapa, as already mentioned, started life as the Southampton, Mark IV. Before it was finally adopted for the R.A.F., it underwent some extremely searching tests. First there was a two hours' flight over the North Sea. This was followed by a flight to the Mediterranean and down the Nile. On this some 15,000 miles were covered.

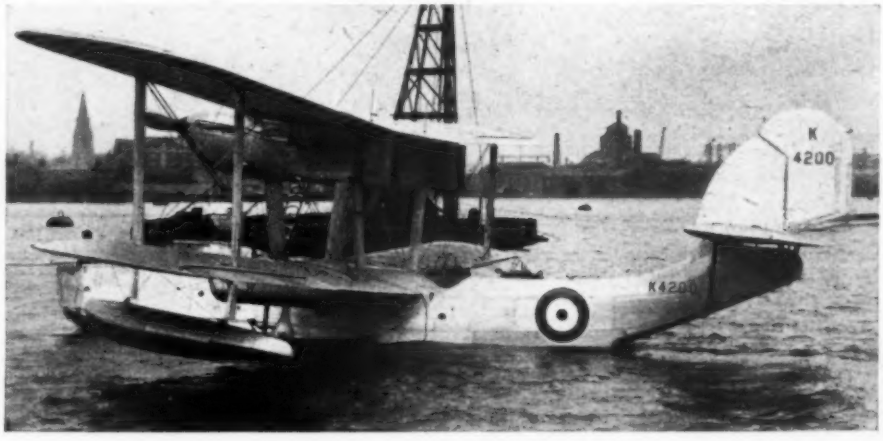
A successor to the Scapa was designed during 1934, and the first machine was launched towards the end of the year. It went to Felixstowe for tests in 1935 as the Southampton, Mark V, but ultimately went into production as the Stranraer. This type has Bristol Pegasus engines, and is still used by the R.A.F.

From the fame which it has already achieved during the present war, it might be thought that the Supermarine Spitfire single-seater fighter is a new machine. Few will probably remember that at the Royal Air Force Display of 1934 there was, among the "New and Experimental Aircraft" a monoplane of that name. It had a "cranked" cantilever wing, and was fitted with a Rolls-Royce steam-cooled Goshawk engine. There is little resemblance between that machine of 1934 and the modern Spitfire. It was much larger, for instance, and had a "trousered" undercarriage.

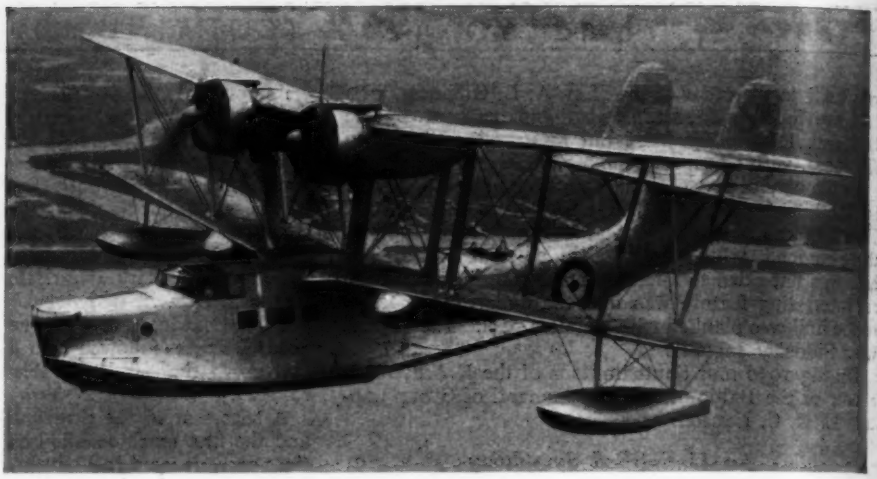
Looking Ahead

But even the Spitfire as we know it to-day was originally designed a good long while ago. In June of 1936, a short time before the R.A.F. Display, a private demonstration was given at Eastleigh aerodrome by the Vickers and Supermarine concerns. On this occasion the Spitfire appeared in pretty much the form in which we know it to-day. It must, therefore, have been designed during 1935, and it is rather amazing that, in spite of this, the Spitfire has such a remarkably good performance. Which only goes to show that Mr. R. J. Mitchell was thinking a long way ahead. That his long experience of designing Schneider Trophy racers stood him in good stead is evident, and the Schneider influence is easily recognisable in the Spitfire. He well deserved the C.B.E. awarded him.

As at present issued to R.A.F. squadrons, the Spitfire is essentially similar to the machine which appeared at



The Scapa had its Rolls-Royce Kestrels placed just under the upper wing. It is to be noted that the radiators were placed at the tail end of the nacelles.



The latest Supermarine pre-war flying boat which may be illustrated is the Stranraer (two Bristol Pegasus engines) shown here. It follows the Scapa in having the engines placed just under the top plane.

the R.A.F. display in 1936, though various refinements have been incorporated.

Despite its robust stressed-skin construction, the airframe is of low weight. The wing is constructed of light alloy, and has a single spar comprising tubular flanges and a plate web. Forward of the spar it is covered with heavy gauge sheet which forms, with the spar web, a stiff, strong torsion box. Aft of the spar, the covering is of thinner gauge. Flush riveting is employed throughout, and the wing tips are detachable.

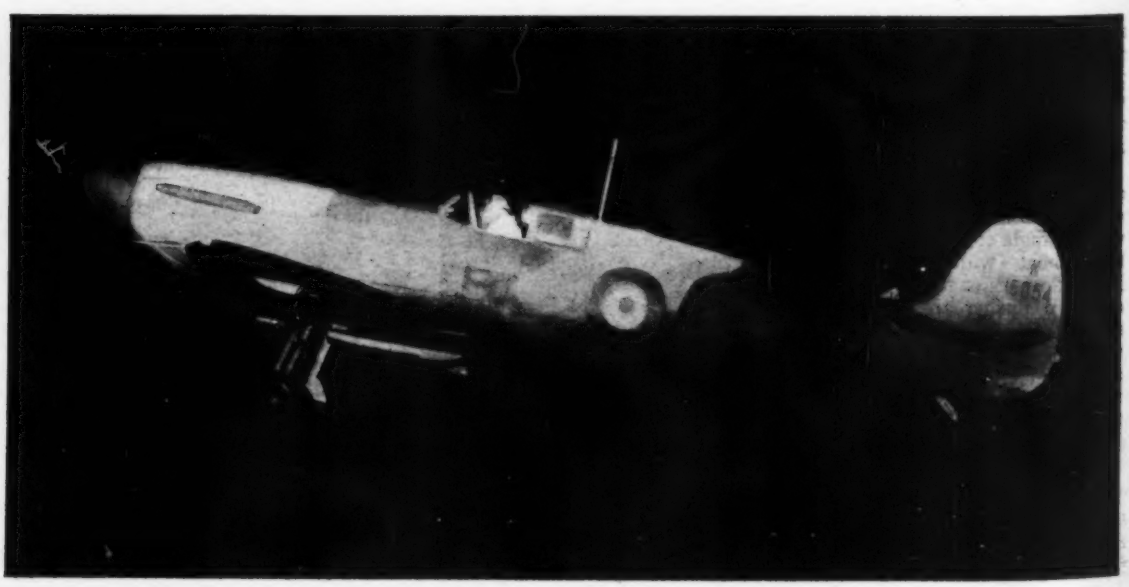
The fuselage is built in three sections. The forward portion is a tubular structure, and forms the engine mounting. Aft of this is a monocoque section, and, finally, comes the tail unit, which is made detachable and is likewise of monocoque construction. The undercarriage retracts outwards, a positive lock being provided in both up-and-down positions.

A Rolls-Royce Merlin engine is standardised, the type now fitted being the Merlin III, giving a maximum of 1,030 h.p. at 16,250ft., though more power is obtainable on the 100 octane fuel now in use. Below the starboard wing is a ducted radiator for the ethyline glycol coolant, the degree of cooling being controlled by a hinged flap. Two fuel tanks are installed in the fuselage aft of the fireproof bulkhead.

With the three-bladed De Havilland variable-pitch airscrew a top speed of 367 m.p.h. is obtainable at 18,400ft., and more recently a further considerable improvement in performance has been obtained since the introduction of 100-octane fuel.

One of the most notable features of the Spitfire is its armament, which is composed of eight free-firing Browning machine guns mounted in the wings. These weapons have a combined rate of fire of about 9,600 rounds per minute.

Of the present activities of the Supermarine works of Vickers-Armstrongs, Ltd., it is not possible to write, for obvious reasons. It may, however, be assumed that worthy successors of the Spitfire in the landplane class and of the Stranraer among the flying boats are in the offing. The death of the firm's chief designer, Mr. R. J. Mitchell, in 1937 was a blow to the company, but he left behind him a well-qualified and well-tested staff, capable of carrying on the splendid Supermarine tradition of which we have endeavoured to give an outline in the preceding pages.



In spite of its high speed the Supermarine Spitfire is docile enough to be used as a night fighter.

Mobile and Fixed AIR FORCES

The Flying Boat Squadrons are more Mobile than any other Units of the R.A.F.

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

(*Continued from page 332*)

This, the third, article by Capt. Macmillan in the series on Air Strategy was written before the recent developments in Scandinavia occurred. Thus, the corridor between Denmark and Holland no longer exists and air entry into North Germany can legitimately be made anywhere between Holland and the South coast of Sweden.

BECAUSE aeroplanes move in straight lines when flying from A to B it is necessary to measure the length of the two corridors of air entry into Germany between Holland and Denmark, Luxembourg and Switzerland. These measure 140 and 150 miles respectively.

Of the two corridors for air attack against Germany, one is useless to French aeroplanes unless they are based in England, and the other is useless to British aeroplanes unless they are based in France. Let us call them the British corridor and the French corridor.

The French corridor is the more deadly base from which to launch Allied aircraft. Here are a few comparative mileages which show the position at a glance.

Distance in miles through French corridor	To	Distance in miles through British corridor
700	Warsaw	880
350	Hamburg	420
400	Berlin	550
700	Königsberg	800
430	Rostock	440
400	Kiel	370
430	Sylt	350
330	Prague	640
400	Vienna	800

Judged solely from the point of view of range, the British corridor possesses an advantage over the French corridor only in relation to a small area in the extreme north-west territory of Greater Germany. Thus one would expect the major proportion of the attack squadrons of the Royal Air Force to be based in France, even if the major part of the defence (fighter) squadrons were retained in Britain.

Now, it is unfortunate that censorship regulations ban reference to the location of R.A.F. units, so this part of the argument must be shorn of direct evidence. But it can be inferred (from the raid on Sylt among other things) that the despatch of the British Expeditionary Force to France did not denude Britain of all the bombing squadrons.

Britain not Denuded

A considerable force of bombers is still retained in the Bomber Command for counter action from Great Britain in spite of the fact that the area which they can attack with greater economy in accordance with the formula *weight of bombs dropped per hour flown* is relatively small.

There must be a reason for this retention of these squadrons in Britain. Clearly it is because the area in question in Germany is believed to be an important one. So it is: from the naval point of view.

That corridor of 140 miles between Holland and Denmark is Germany's naval outlet to the North Sea. And behind that corridor lies the hinterland of German naval bases, shipyards and organisation.

It can be no part of British naval plans to be bereft of adequate bombing support for naval purposes. One can imagine the uproar at the Admiralty if the War Office were to suggest that all bombers were of more use in France.

The French corridor is the corridor for land warfare against Germany.

The British corridor, on the other hand, is the corridor for naval warfare. And the area of action for bombers (unlike that of the French corridor) lies on both sides of the British corridor, encompassing a relatively small area of land and a big area of sea.

Thus it seems probable that the bomber sections of the Royal Air Force in France and in Britain will develop into specialist sections with specific knowledge of military operations on the one hand and of naval operations on the other. If this should prove to be the case, each section will become a fixed force, one acknowledgely attached to the army and the other secretly bequeathed to the navy.

And perhaps before the Royal Air Force becomes aware of what has happened, it will be split up into the component parts from which it was created in 1918.

The Air Ministry would then (as a sop) be left as an entity controlling the functions of design, inspection, testing and supply; if steps are taken in time it may still possess an operational section of the present air force as an independent unit; but that will happen only if a good enough case can be made out for the retention of a mobile air section which can be despatched to any front with greater rapidity than any other branch of the armed forces of the Crown.

I believe that there is a growing possibility (I would not rate it higher yet) that the Air Ministry will be faced with a crisis of disintegration as great as the crisis of integration which fell upon the Directorate of Military Aeronautics and the Naval Air Department twenty-four years ago.

If this crisis comes, it will come because the Air Ministry has had to face a new war—indeed its first great war—while yet its destinies were presided over by officers trained in their youth in the ways of Army and Navy. If the war had come, say, twenty years later the Air Service would have had air training throughout all its higher ranks and the Trenchard Cranwellian doctrine would have stood the test of inter-Departmental strife. But the war has come too soon for that.

Some few months before the war began in September, 1939, Lord Trenchard crossed swords in the House of Lords with Lord Chatfield over the policy then in vogue in relation to the R.A.F. Trenchard said the way to win a war was to strike at the enemy's source of supply of aircraft, and at his aerodromes. He therefore advocated concentration upon bombers. But at that time a policy decision had been reached to double the rate of production of fighters. Chatfield, as Minister for Co-ordination of Supply, took the line that fighter defence was right because if so many aircraft were shot down on each raid the enemy's strength would be rapidly exhausted. But that was in the days of pre-war partial (political) appeasement; fighter aircraft could be said to be built without exhibiting aggressive intentions.

And the Air Ministry sat back and allowed its Service to be the servant of a sycophantic political performance.

The long range fighter was not produced soon enough. The Blenheim fighter version is only a makeshift, however good it may be. Until there are real first-class long-range fighter squadrons to support the bombers, and adequate air transport for supply, staff, personnel and all the equipment needed for a self-contained section of the Air Force to operate in any given field and to get there with the speed of flight, the Air Ministry will lack the strength of case it ought to have to hold its own against the predacity of the older Services, who showed in the 1914-1918 war that they were willing to maintain their battles on the home front even when engaged in war with a mighty enemy abroad.

Any such attempt to disintegrate the Air Force ought to be frowned upon from the outset. For this reason: That, if the air squadrons were again to be tied to the Army and Navy, as they were from 1914 to 1918, they would be used by the two older Services for Army and Navy purposes, as the sections in France and Britain are being used today. The speed of transition of the fastest section of the Air Force would then come down to the speed of transition of the Navy and the Army. And as the Navy is responsible for the safe transport of the Army overseas, the Air Force would be reduced to a speed of something under thirty knots.

A sudden flare up on a new front (as may well happen at any time in this war) would best be countered by the Air Force in full mobile trim at the outset until other forces could get there.

Such a section of the R.A.F. could have gone into action in Poland and in Finland had it existed. The tragedy was that it wasn't in existence then. If the Air Force is sold to the Army and the Navy it never will exist until other nations force it upon us by taking the initiative.

FLIGHT

MAY 9, 1940

ROYAL AIR FORCE NUMBER

ON Thursday, May 9, a special number of "Flight" will be published devoted to the different branches and training of the R.A.F. of to-day on its present vast scale of wartime operation.

The Coastal Command

No great retentive powers of memory are needed to recall the wave of agitation that swept under Admiralty Arch to flood the political arena with a blue sea demand for sweeping changes in air administration, and the restoration of the Fleet Air Arm and shore-based flying boats to unilateral control by the Admiralty. The Cabinet of the day decided that the Admiralty should have undivided control of the Fleet Air Arm ashore and afloat, and I believe most people will agree that it was a wise decision. But the Admiralty did not succeed in their plea to obtain similar control over the shore-based flying boats.

Already this war has lasted long enough to estimate the practical result of the collaboration between the naval-controlled surface ships and the Air Force-controlled flying boats.

In some respects the flying boats of the Coastal Command represent the most mobile section of the Royal Air Force. Apart from record breaking attempts, flying boats undertook the longest air cruises prior to the war. They are the most self-sufficient section of the R.A.F. Their aerodrome is to be found on any

sheltered water. Their own crews are able to maintain them in ordinary running trim, and could do more extensive overhauls if it were necessary. In fact, the flying boats are far more characteristically naval than are the landplanes borne in aircraft carriers. With the flying boats it is difficult to tell where the air connection ends and the sea tradition begins, so much do they overlap.

The pilots who flew the F2a s and the F3s of the war of 1914-1918 were entirely naval in their outlook, although many of them were not naval officers, but enthusiasts who joined the Royal Naval Air Service direct soon after the war began. Quickly they sloughed the ways of the landlubber and garbed themselves mentally in the ways of the sea. The work they did was much the same as that which is being done by the pilots of flying boats to-day, but their activities were confined to the North Sea, for Felixstowe and Yarmouth were the two great flying boat stations.

To-day the flying boats vet the waters far out over the Atlantic, the Sunderlands go booming past the rock cliffs of Cornwall, the boats of one type and another comb all the British coasts for enemy activity. During the summer months they will be on almost continuous patrol throughout the twenty-four hours.

Almost Unchanged

There is a closer likeness between the work of the flying boats of the R.N.A.S. in 1914-1918 (for that section of the Air Service was little affected by the merging of the two branches into the R.A.F. in April, 1918) and that of their successors of the R.A.F. to-day than there is between any other air unit of the last war and of this war. That includes not only the duties carried out but the duration of flight patrols. So a comparison may be made in the case of the flying boats with greater fairness than could be made with ship-borne aircraft which were virtually non-existent until after the Armistice in 1918 except for seaplanes craned into and out of mother ships.

The result of that comparison, judging by the work of the flying boats of the Coastal Command up to date, is that the efficiency of the successors of the "Spider Web Patrol" is unexceptionable.

So the Cabinet decision, taken in time of peace, that the R.A.F. would continue to man, control and administer the shore-based flying boats has been fully justified.

The crews of the flying boats evince a spirit of rivalry with the work of the surface craft of the Navy which keeps them in constant trim for the often tedious hours of patrol over the deep waters. And in my opinion it is more important that the men in the flying boats shall be airmen than that they shall be sailors, for the airman looks at the sea in a different way.

You know that picture of Uncle Sam which used to be more often seen than it is to-day; a picture of an old gentleman in eighteenth century clothes standing with his torso thrown back and his head held so that he has the appearance of a man of lofty purpose looking down at the lesser people scrambling vulgarly beneath his gaze. Well, that's how the flying boat pilots have struck me when I've flown on patrol with them during exercises, as gazing down with the placid superiority of that figurative Uncle Sam. And that is just about the best way to regard the meretricious sea warfare of the new Germany.

Although in peacetime the flying boats of the Coastal Command were the most mobile units in the R.A.F., since this war began they appear to have been diverted into a fixed force operating from fixed bases. Indeed, some of the flying boats which took up temporary outstations when the war began have been restored to permanent stations.

That can be ascribed to two causes—one, the static nature of the war during its early period, and, two, the greater ease of administration and control when the flying boats are stationed at a regular base. The first of these causes is outside the control of the Air Ministry, for the choice between a war of attrition and a war of demolition does not rest with a Service Department. But the second factor does indicate that insufficient attention has been paid to staff organisation for the easy control in war of highly mobile units.

As with the mobile force which I have suggested ought to be created to enable the R.A.F. to send a complete contingent to any theatre of war with the speed of the aeroplane, so ought the Coastal Command to be able to despatch units of flying boats complete with their own flying transport and their own flying staff headquarters anywhere at a moment's notice.

But if there is one vein in the Air Force upon which a finger can be placed to find a feeble pulse-beat, it lies in the failure to provide for the fully self-contained staff and operational flying unit.

To enable units of the flying boats of the Coastal Command to operate to the maximum of efficiency under all circumstances (and one must allow for circumstances which may arise through a termination of the period of quiescent war) there ought to be a flying staff and an air-borne staff headquarters. Can one imagine a naval fleet operating successfully without its own ship-borne staff which includes officers of the highest naval rank? (And it is often suggested that the greatest period in Britain's naval history was reached before modern communications put the Admiralty into touch with every ship at sea.)

Air Coastguards

The same argument applies to the landplanes of the Coastal Command, but to a lesser extent because there are many parts of the world where an expeditionary force of sea-sweeping landplanes could not operate with the same degree of safety as an expeditionary force of flying boats. For there are many more natural sea aerodromes than there are natural land aerodromes. So the landplanes of the Coastal Command may be likened to a permanent force of air coastguards whose duty is to remain in Great Britain. That is as it should be. And similar guards ought to be stationed permanently along the coasts of the Empire except for those parts where flying boats could do the work more economically on account of terrestrial conditions.

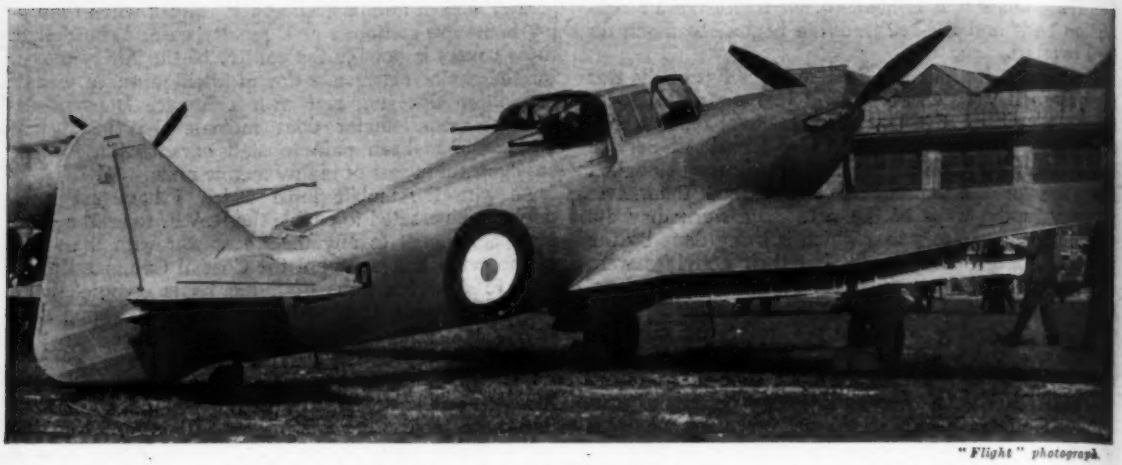
There is but one advantage which a naval flying boat might possess over an Air Force flying boat; that is, it might conceivably be classed as a warship and so obtain the same rights of international navigation as ships in time of war. What a boon it would be to flying boats in time of war if they could seek refuge in a neutral harbour in stress of weather, or obtain fuel and non-military stores. And if flying boats were reclassified as warships there is no reason why they should not have those privileges.

It might be worth the investigation of the proper legal departments of the Crown to endeavour to establish such privileges for flying boats, for it would make them of great assistance to the Navy overseas.

Meanwhile, I believe the Air Ministry must solve the problem of the entirely mobile flying boat force, or sooner or later surrender its right to do so to the Admiralty.

(Next week: *"Equip for Frigid Zone."*)

SERVICE AVIATION



"Flight" photograph.

TURRET FIGHTER: The Boulton Paul Defiant two-seater fighter which mounts a four-gun "B.P." turret. This type has not yet been in action but should prove an extremely dangerous opponent to bombers.

Royal Air Force and Official Announcements

Air Minister's Appointment

THE Air Ministry announces that the Rt. Hon. Sir Samuel Hoare has appointed Lt. Col. J. T. C. Moore-Brabazon to be his Parliamentary Private Secretary at the Air Ministry.

Bigger Allowances for Airmen

A REVISED scale of allowances for children of airmen of the Royal Air Force came into operation recently. The new scale of allowances is as follows:—6s. a week for one child; 10s. a week for two children; 12s. a week for three children; 3s. a week extra for each additional child. All additional payments due under the revised scale will be made automatically. Application by the airmen concerned or their wives is not necessary.

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—L.A/C. J. B. Ball (524840); P/O. P. D. W. Brierley (42046); P/O. J. G. Perry (40424); P/O I. Stapledon (40438); Sgt. W. J. Wetton (580533).

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED," NOW REPORTED KILLED IN ACTION.—Sgt. W. F. L. Cole (366072).

WOUNDED OR INJURED IN ACTION.—A/C.2 W. G. J. Cruikshank (817032); F/O. J. R. Garrett (90037); Sgt. E. Marshall (580092); Cpl. H. J. Strawson (561646); L.A/C. J. Walton (812061).

MISSING.—F/O. C. H. Boxall (37903); A/C.1 A. C. Hamman (551348); F/O. G. Harries (39520); Sgt. H. H. Kelleway (561573); L.A/C. W. W. Martin (536352); Sgt. L. Podger (580525); Sgt. D. W. Wilson (566477); L.A/C. E. L. Wolverson (544700).

KILLED ON ACTIVE SERVICE.—F/O. R. H. Bullard-Davies (39372); Cpl. F. Coughtrey (533672); F/O. D. Devoto (39228); L.A/C. D. G. Doughty (551342); Sgt. O. W. Dumbreck (580537); Sgt. R. C. Edwards (904369); P/O. J. O. Griffits (41692); P/O. J. D. Hargreaves (77035); F/O. J. P. M. Hewett (39878); P/O. H. S. P. Hulton (33428); A/C.2 R. C. T. Humphreys (637242); P/O. H. A. Innes, D.F.C. (40227); A.F/O. R. L. Jeffery (70861); Act. Flt. Lt. C. R. Mace (39467); P/O. R. C. Mathieson (40933); Sgt. R. M. Nelson (580853); A/C.2 E. J. Robinson (633025); Sgt. R. H. I. Scott-Kerr (748592); A.P/O. R. A. Sims (42654); L.A/C. R. R. Smith (751145); Sgt. J. D. Stein (748214); Sgt. J. G. Stewart (908163); A/C.1 W. F. Taylor (545991); Sgt. C. Wall (580439); Sgt. A. H. Woodward (580688).

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—L.A/C. A. C. Beech (751002); P/O. J. P. Dalton (71524).

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. R. Bruce (74715); A/C.1 W. Charles (541556); P/O. C. P. R. Collier (40464); Act. Sqn. Ldr. I. G. E. Dale (19182); Act. Sgt. H. Dean (581276); Act. Sgt. J. A. D. Dobbing (580971); Act. Flt. Lt. J. M. Griffith-Jones (37734); A.P/O. J. Hemingway (41922); Cpl. G. E. Lapwood (567727); F/O. E. B. Morse (39446); P/O. P. D. B. Stevens (41329); L.A/C. C. E. E. Thomas (526462); A.P/O. J. D. Towlson (41964); Sgt. P. I. Watson-Parker (741433).

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. J. G. S. Kirkpatrick (741757).

DIED ON ACTIVE SERVICE.—Flt. Lt. R. D. Boyd (74904); Cpl. G. E. Catmore (564599); L.A/C. G. A. Gosden (546220); A/C.2 I. D. Jones (980948); Sgt. W. H. R. Kneale (537471); A/C.2 G. Moore (638683).

London Gazette

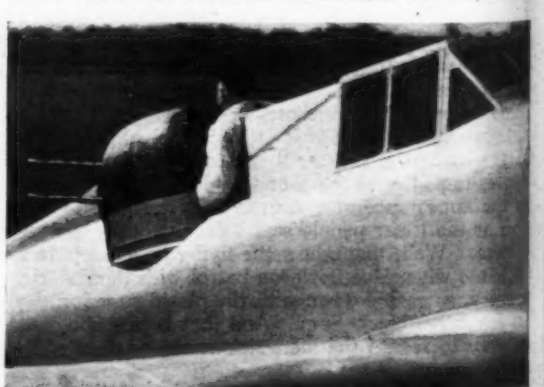
Royal Air Force

Air Chief Marshal Sir Edgar R. Ludlow-Hewitt, K.C.B., C.M.G., D.S.O., M.C., is appointed Inspector General of the Royal Air Force vice Marshal of the Royal Air Force Sir Edward L. Ellington, G.C.B., C.M.G., C.B.E. (April 4); A.V.-M. (Acting Air Marshal) E. L. Gossage, C.B., C.V.O., D.S.O., M.C., is appointed Air Member for Personnel on the Air Council vice Air Vice-Marshal (Acting Air Marshal) C. F. A. Portal, C.B., D.S.O., M.C. (April 2).

General Duties Branch.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation:—(Jan. 17) Sgt. A. Roman, Cpl. J. S. C. Morgan, L.A./C. W. E. Nicholas.

The following Pilot Officers on probation are confirmed in their appointments on the dates stated:—(Jan. 6) T. Watson; (Jan. 23) A. H. N. Gooch; (Feb. 6) P. J. C. Harper, W. Surtees; (Feb. 14) K. A. Cockerell; (Feb. 15) W. S. Worner; (Feb. 20) E. K. Kitson; (March 7) C. H. Robinson; (March 8) I. C. Chalmers, G. B. Treasure; (March 13) A. J. S. Algeo, C. J. Arthur, R. W. Ayres, R. E. Bailey, E. L. Baudoux, C. C. Bennett, E. G. Bidgood, A. F. Booth, M. K. Brown, M. A. Bussey, F. W. Cale, H. D. Carruthers, H. P. Clark, S. G. Collins, W. R. Corkhill, J. M. Derbyshire, L. T. Dixon, R. A. Durie, R. H. Edwards, F. R. C. Elger, S. R. Gane, V. B. H. Gane, A. H. H. Garrad, W. H. G. Gordon, A. L. Hamilton, K. T. Hannah, A. R. E.



"Flight" photograph.

A NEW VIEW of the Boulton Paul four-gun turret as installed on the Boulton Paul Defiant. It will be gathered that exit is comparatively easy.

"Flight" photograph.

FLEET AIR ARMAMENT: A close-up of a Blackburn Roc two-seater naval turret fighter. Like the Defiant this machine has a Boulton Paul turret with four Browning guns. It will be seen that this operates in conjunction with retractable fairings. Another point to notice is that there are bomb racks beneath the wings.

Hayter, A. E. Hill, G. E. Hill, A. J. Holderness, J. R. Hyde, D. F. Jones, M. M. Lambert, M. C. A. Linden, B. M. McDonough, K. B. McGlasham, K. I. Mackenzie, R. I. C. Macpherson, D. G. Macqueen, E. D. Pennington, J. F. H. Peters, R. H. Rigby, G. W. S. Ritchie, G. M. Robinson, P. G. Royle, M. E. Ryan, H. C. Sheldon, J. B. Smiley, D. H. Stuart, P. F. C. Villiers-Tuthill, R. J. Whight, R. H. Wiens, J. M. Wilkin; (March 14) F. W. Chadwick, G. A. Madore, J. W. B. Stevenson; (March 16) G. M. Baird, A. E. Q. Bourgeois, J. R. Cronan, A. L. Fowler, P. W. Horton, E. E. Howarth, K. A. Lawrence, M. E. B. Macassey, E. H. McHardy, D. A. Todd, R. M. Trousdale, V. B. Verity, R. M. Walker, W. S. Williams; (March 17) M. A. Butler, E. F. K. Campling, J. H. Edwards, A. Harte-Lovelace, D. T. Jay, R. A. Marchand, J. L. Moore, H. G. R. Pirie, A. J. Strachan; (March 20) R. F. T. Doe, P. G. Evans, T. Kerr; (March 21) K. Beil; (March 27) D. C. Barker, J. W. Blennerhassett, B. S. Booth, C. W. W. Darwin, E. J. Durston, F. W. Gilmore, J. H. Godwin, R. R. Green J. E. S. Hill, R. James, R. A. Kirkwood, A. Leeson, G. J. Lynes, E. A. McLundie, G. W. Nicholson, R. T. Pareezer, R. Rustom, T. B. A. Sherrington, F. B. Weir, D. R. West, R. J. S. Wootton.

Acting Pilot Officer on probation K. Illingworth is graded as Pilot Officer on probation (Dec. 6, 1939).

The following Pilot Officers are promoted to the rank of Flying Officer (March 27):—H. G. McCallum, K. H. Burns, F. N. Brinsden, J. H. Player, R. T. George.

F/O. A. J. Carver takes rank and precedence as if his appointment as Flying Officer bore date Feb. 15. Reduction to take effect from Feb. 23; F/O. N. M. Thomas takes rank and precedence as if his appointment as Flying Officer bore date June 4, 1939. Reduction to take effect from March 5; P/O. A. R. D. Barratt takes rank and precedence as if his appointment as Pilot Officer bore date April 25, 1939. Reduction to take effect from Feb. 23; P/O. A. W. Matthews takes rank and precedence as if his appointment as Pilot Officer bore date Aug. 31, 1938. Reduction to take effect from March 5; Group Capt. T. C. Thomson is placed on the retired list (April 9).

The following relinquish their short service commissions on account of ill-health on the dates stated:—(April 1) F/O. T. F. Harvey; (April 10) A.P/O. J. A. D. Wallet.

The short service commissions of the following Acting Pilot Officers on probation are terminated on cessation of duty on the dates stated:—(Jan. 2) D. F. Brooks, G. R. L. Gaunt; (March 30) C. D. L. Wanklyn.

Equipment Branch.

Warrant Officer S. W. Waller is granted a commission as Flying Officer on probation with effect from Jan. 25, and with seniority of Sept. 18, 1939.

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(March 6) P. P. Butler, J. Hamilton, R. W. Head, E. F. Wisdom; (March 27) A. P. B. Moore, J. M. Howard, D. Moulden.

Accountant Branch.

Flying Officer on probation H. G. A. Orbell is confirmed in his appointment (Dec. 21, 1939).

Medical Branch.

The following are appointed as Medical Officers with the relative rank of Flying Officer (March 12):—Miss E. D. Fenwick, M.R.C.S., L.R.C.P.; Miss A. D. M. Adams, M.R.C.S., L.R.C.P., B.M., B.Ch.; Miss W. H. Redmond, M.R.C.S., L.R.C.P.

Dental Branch.

F/O. R. A. Abbey, L.D.S., is promoted to the rank of Flight Lieutenant with effect from April 3, and with seniority of Nov. 2, 1939.

PRONE TO ATTACK: A bomb-aimer demonstrates the use of the prone position on the floor of the Fairey Battle bomber. Large numbers of these strong, versatile single-engined machines are in use in France.

BLENHEIMS IN FRANCE: An impressive piece of formation work by Bristol Blenheim reconnaissance-bombers in France. At the time of writing, machines of this type are standing by with bomb racks full.

SERVICE AVIATION (CONTINUED)

Dronsfield, W. A. Hemmant; (March 6) J. Whittaker; (March 7) P. G. Gardiner, G. C. Jobling; (March 9) R. H. Sharp, D.F.C.; (March 10) W. A. Lane, R. F. Tothill; (March 11) N. P. Anson, F. N. B. Bennett, L. A. Combes, J. H. L. B. Davies, W. C. Hart, L. R. Langmead, W. A. Peggs, W. J. H. W. Shewry, W. F. Taylor; (March 12) S. Bosworth-Martin, P. H. E. Grisewood; (March 13) A. E. Mitchell, H. St. G. S. Scott, C.B., D.S.O., H. W. Smith, A. W. Stevens; (March 14) T. R. Hancock, K. A. Hiskens, J. E. Kendrick, D.F.C., A. H. Patey-Briggs, A. W. Porter, T. A. Pringle, F. D. J. Silwood, A.F.C., J. H. Smith; (March 15) S. D. Antill, B. S. B. Bavlis, R. G. Burns, C. R. F. Cullum, E. L. Elric, W. A. J. Gribbin, G. Hampson, P. F. Jackman, C. T. Mansell, F. S. Michael, D.C.M., H. W. Moore, H. S. Murdock, H. M. Pezzani, E. C. Potter, R. P. B. D. Radclyffe, N. A. Rowe, G. H. E. Roxburgh, J. Town, D.F.C., L. L. Walters; (March 16) W. Parke, A. R. Weyer; (March 17) J. S. Downward, A. H. Partner; (March 18) H. C. Back, L. C. Cesek, W. S. Chaney, B. F. Coopman, N. M. Ffrench, J. H. Lewis, R. E. R. Lloyd, E. F. Longrigg, D. C. Macdonald, P. D. McNeil, F. M. Partington, R. Perritt, J. G. L. Pommerol, T. W. Pool, A. J. Salton, P. E. Underwood, M. T. Wright; (March 19) J. H. Cooper, M.C., J. B. A. Hayter, R. T. Newton; (March 20) H. Baxter; (March 21) N. C. K. Dibble, L. A. Goss; (March 22) P. A. X. Gaugain.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—(Sept. 2, 1939) M. W. Baseden; (Sept. 6, 1939) C. E. Hurst; (Sept. 7, 1939) J. F. Powell, J. J. L. Patterson (substituted for notification in the *Gazette* of Oct. 3, 1939); (Sept. 8, 1939) G. J. Pytches; (Sept. 9, 1939) L. Evans, I. E. Roberts; (Sept. 18, 1939) W. Ridley, D.F.C.; (Sept. 20, 1939) P. E. Tyndall; (Nov. 26, 1939) E. M. C. Shipp.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Sept. 18, 1939) J. C. E. Luard; (Sept. 21, 1939) J. Molesworth-St. Aubyn; (Sept. 23, 1939) W. R. F. Fisher, W. V. Trubshawe, E. A. Huntingdon-Whiteley; (Oct. 1, 1939) J. Elliott; (Oct. 12, 1939) G. P. Dealtry, C. C. Danvers; (Dec. 13, 1939) H. G. Lewis.

Pilot Officer on probation C. R. Barke resigns his commission (March 30); Flt. Lt. R. J. Findlay is dismissed the Service by sentence of General Court-Martial (March 22).

Equipment Branch.

I. W. Pearson is granted a commission for the duration of hostilities as Acting Pilot Officer on probation (March 18); P/O. G. J. Gilbody is promoted to the rank of Flying Officer (Feb. 9).

The commissions of the following are terminated on cessation of duty (April 3):—Pilot Officer on probation C. W. J. A. Homan, Acting Pilot Officer on probation P. J. J. Stellakis.

Meteorological Branch.

Acting Pilot Officer on probation R. B. Barnes relinquishes his commission on account of ill-health (April 5).

Medical Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Flight Lieutenant (March 12) A. M. G. Campbell, D.M., M.R.C.P.; Flying Officers (March 5) E. B. D. Bangay, M.B., B.S., M.R.C.S., L.R.C.P.; (March 12) W. Anderson, M.B., Ch.B., J. Brown, M.B., Ch.B., W. Goulstone, M.B., B.Ch., M.R.C.S., L.R.C.P., H. G. Magill, M.B., B.Ch., A. B. Rowlands, M.B., Ch.B.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(March 21) T. D. Spencer, M.R.C.S., L.R.C.P.; (March 28) R. F. Dawson, M.B., Ch.B., J. Park, M.B., Ch.B., W. M. D. Robertson, M.B., Ch.B.

Chaplains Branch.

The following are granted commissions for the duration of hostilities with the relative rank of Squadron Leader on the dates stated:—(March 18) The Rev. H. G. Lewis; (March 18) The Rev. D. G. Benson, B.A.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

The following Flying Officers are promoted to the rank of Flight Lieutenant (Sept. 3, 1939):—G. H. Welsh, D.F.C., H. V. Barker, P. K. Campbell, C. Gardner, H. T. Townsend, A. R. Turpin, A. E. B. Bateman, J. S. Newall, E. C. Brown, P. R. Stroud, G. H. Smith, R. D. Wayman, M. E. de L. Hayes, H. V. Crowder, H. T. A. Silcox, A. A. Leslie, A. Haywood, J. Addison, E. L. Brackenbury, A. C. Bailey, D. E. Milson, J. Nesbitt-Dufort, M. W. Kimpton.

P/O. L. G. B. Reid is promoted to the rank of Flying Officer (March 23); Flt. Lt. R. S. G. C. Lucy, A.F.C. (Squadron Ldr., R.A.F., Ret.) is granted the rank of Squadron Ldr. in Class CC (Oct. 9, 1939).

Equipment Branch.

Flt. Lt. H. T. Evans relinquishes his commission on cessation of duty (Feb. 20).

Royal Air Force Volunteer Reserve

General Duties Branch.

The following are granted commissions as Pilot Officers on probation on the dates stated:—(Feb. 1) D. W. Hogg; (Feb. 5) R. J. Falk; (Mar. 17) Leading Aircraftmen D. E. Patterson, J. Turnbull, R. C. Sterling, D. A. Strachan, J. J. Tozer, W. Murray, A. McLaggen.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Feb. 4) D. E. L. Clark, J. C. Cowper, R. G. Fennell, J. H. F. Hansen, G. F. Hogg, J. C. Page, W. F. Ward, S. J. S. Wilde, J. Wilk, M. H. Ross, J. W. Chubb, H. C. T. Graham, J. Grocott, P. H. Hazleman, G. B. Hougton, H. Quittenden, F. R. Arnold; (Feb. 6) W. A. H. Chapman, K. H. Potter, R. Scott, L. W. Simpson; (Feb. 7) C. T. Martin; (Feb. 26) C. A. Bell, L. M. Hamilton, C. J. F. Hare, R. McK. Jamison, J. Lynch-White, J. G. Mackay, D. H. Murphy, L. C. J. Smith; (Mar. 2) F. J. Drake-Carnell, B. Green, L. G. Johnson, T. H. N. Lane, A. E. Lovett, W. Mailer, A. E. V. Oliver, L. W. J. Watt, R. G. M. Whigham, E. S. Arnold, F. G. Baker, A. C. Block, G. S. Bliss, T. T. Davies, L. Duckworth, R. W. H. Echlin, A. G. F. Hobbs, J. S. Hobhouse, E. Pennington, J. D. Peterkin, B. L. A. Pusey, C. S. Pyne, E. A. M. Sack, A. T. Sword-Daniels, H. W. M. Wakeley; (Mar. 9) F. W. Journeaux, H. C. F. Barran, R. J. Lennox-French, A. D. L. Mackinnon, R. F. Walker.

P/O. D. M. Walbourn is promoted to the rank of Flying Officer (May 9, 1939); P/O. E. M. Woods resigns his commission (March 30).

The following Flight Lieutenants relinquish their hon. commissions on cessation of duty on the dates stated:—(Dec. 9, 1939) R. P. T. Ffrench, M.C.; (Feb. 4) C. L. Leake, O.B.E., M.C.

Administrative and Special Duties Branch.

J. J. G. Clark is granted a commission as Pilot Officer on probation (Acting Flight Lieutenant (unpaid)). (Aug. 26, 1939.) (Substituted for notification in *Gazette* of Jan. 5).

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—(Feb. 19) K. J. B. Munro; (Feb. 21) H. M. D. Walker; (Feb. 23) R. Leycester, M.C.; (Feb. 26) L. J. Bailey, J. A. Payne, H. Perceval; (Feb. 23) S. E. Hancox; (March 1) W. E. Clarke; (March 2) D. W. Carlisle, F. F. Wells; (March 5) A. J. Dronsfield, W. A. Hemmant; (March 6) J. Whittaker; (March 7) P. G. Gardiner, G. C. Jobling; (March 9) R. H. Sharp, D.F.C.; (March 10) W. A. Lane, R. F. Tothill; (March 11) N. P. Anson, F. N. B. Bennett, L. A. Combes, J. H. L. B. Davies, W. C. Hart, L. R. Langmead, W. A. Peggs, W. J. H. W. Shewry, W. F. Taylor; (March 12) S. Bosworth-Martin, P. H. E. Grisewood; (March 13) A. E. Mitchell, H. St. G. S. Scott, C.B., D.S.O., H. W. Smith, A. W. Stevens; (March 14) T. R. Hancock, K. A. Hiskens, J. E. Kendrick, D.F.C., A. H. Patey-Briggs, A. W. Porter, T. A. Pringle, F. D. J. Silwood, A.F.C., J. H. Smith; (March 15) S. D. Antill, B. S. B. Bavlis, R. G. Burns, C. R. F. Cullum, E. L. Elric, W. A. J. Gribbin, G. Hampson, P. F. Jackman, C. T. Mansell, F. S. Michael, D.C.M., H. W. Moore, H. S. Murdock, H. M. Pezzani, E. C. Potter, R. P. B. D. Radclyffe, N. A. Rowe, G. H. E. Roxburgh, J. Town, D.F.C., L. L. Walters; (March 16) W. Parke, A. R. Weyer; (March 17) J. S. Downward, A. H. Partner; (March 18) H. C. Back, L. C. Cesek, W. S. Chaney, B. F. Coopman, N. M. Ffrench, J. H. Lewis, R. E. R. Lloyd, E. F. Longrigg, D. C. Macdonald, P. D. McNeil, F. M. Partington, R. Perritt, J. G. L. Pommerol, T. W. Pool, A. J. Salton, P. E. Underwood, M. T. Wright; (March 19) J. H. Cooper, M.C., J. B. A. Hayter, R. T. Newton; (March 20) H. Baxter; (March 21) N. C. K. Dibble, L. A. Goss; (March 22) P. A. X. Gaugain.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—(Sept. 2, 1939) M. W. Baseden; (Sept. 6, 1939) C. E. Hurst; (Sept. 7, 1939) J. F. Powell, J. J. L. Patterson (substituted for notification in the *Gazette* of Oct. 3, 1939); (Sept. 8, 1939) G. J. Pytches; (Sept. 9, 1939) L. Evans, I. E. Roberts; (Sept. 18, 1939) W. Ridley, D.F.C.; (Sept. 20, 1939) P. E. Tyndall; (Nov. 26, 1939) E. M. C. Shipp.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Sept. 18, 1939) J. C. E. Luard; (Sept. 21, 1939) J. Molesworth-St. Aubyn; (Sept. 23, 1939) W. R. F. Fisher, W. V. Trubshawe, E. A. Huntingdon-Whiteley; (Oct. 1, 1939) J. Elliott; (Oct. 12, 1939) G. P. Dealtry, C. C. Danvers; (Dec. 13, 1939) H. G. Lewis.

Pilot Officer on probation C. R. Barke resigns his commission (March 30); Flt. Lt. R. J. Findlay is dismissed the Service by sentence of General Court-Martial (March 22).

Equipment Branch.

I. W. Pearson is granted a commission for the duration of hostilities as Acting Pilot Officer on probation (March 18); P/O. G. J. Gilbody is promoted to the rank of Flying Officer (Feb. 9).

The commissions of the following are terminated on cessation of duty (April 3):—Pilot Officer on probation C. W. J. A. Homan, Acting Pilot Officer on probation P. J. J. Stellakis.

Meteorological Branch.

Acting Pilot Officer on probation R. B. Barnes relinquishes his commission on account of ill-health (April 5).

Medical Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Flight Lieutenant (March 12) A. M. G. Campbell, D.M., M.R.C.P.; Flying Officers (March 5) E. B. D. Bangay, M.B., B.S., M.R.C.S., L.R.C.P.; (March 12) W. Anderson, M.B., Ch.B., J. Brown, M.B., Ch.B., W. Goulstone, M.B., B.Ch., M.R.C.S., L.R.C.P., H. G. Magill, M.B., B.Ch., A. B. Rowlands, M.B., Ch.B.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(March 21) T. D. Spencer, M.R.C.S., L.R.C.P.; (March 28) R. F. Dawson, M.B., Ch.B., J. Park, M.B., Ch.B., W. M. D. Robertson, M.B., Ch.B.

Chaplains Branch.

The following are granted commissions for the duration of hostilities with the relative rank of Squadron Leader on the dates stated:—(March 18) The Rev. H. G. Lewis; (March 18) The Rev. D. G. Benson, B.A.

Auxiliary Air Force

General Duties Branch.

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers:—(Sept. 3, 1939) G. H. Hitchings, H. T. Rees, J. W. Armitage, G. M. Palmer, K. C. M. Stock, M. E. Wilsher, A. D. M. Pitt.

No. 910 (COUNTY OF ESSEX) SQUADRON.—Flt. Lt. D. L. Davis resigns his commission (Feb. 20).

Equipment Branch.

Flt. Lt. T. Calcott, M.B.E. (I.A., Ret.), relinquishes his commission on appointment to a commission in the Royal Air Force Volunteer Reserve (Sept. 1, 1939).

Auxiliary Air Force Reserve of Officers

General Duties Branch.

P/O. M. T. Harraway is promoted to the rank of Flying Officer (Feb. 26).

MODERN TECHNIQUE

Flight Copyright Drawing

The Axis Powers seem to be "going nap" on specialised dive-bombers with air brakes to retard the speed in a dive. Last week Germany's Ju 88 was illustrated, and here is an impression of Savoia-Marchetti S.M. 85 twin-engined dive-bombers. It will be seen that the air brakes are lowered to 90 degrees for diving. The bomb load is stowed internally.

WAR in the AIR

A VERY BAD MISTAKE. This official photograph showing four German seaplanes moored off Bergen, with a bomb dropping in the left-hand corner, was issued with a caption stating that the aircraft were Heinkel He 115 bombers. After close examination *Flight* has come to the conclusion that the machines shown are Junkers Ju 52s. An error of this sort could have grave consequences in view of the fact that naval operations might have been conditioned by the assumption that modern torpedo-bomber aircraft were based at Bergen, whereas the machines were actually some of the old transports.

The Norway Campaign : Two German Cruisers Sunk by Bombs : Raids on Scapa Repulsed

GERMANY'S invasion of Denmark and Norway was briefly mentioned in our last issue. Denmark, very wisely, offered no resistance, for the country was in no condition to do so. Norway, though almost unarmed, for her Army is small and its air arm minute, prepared to resist to the utmost of her power. A mountainous country offers possibilities of resistance which do not exist in a flat country like Denmark, especially as Norway could only be invaded either through Sweden (a route which it did not suit German policy to take) or by sea.

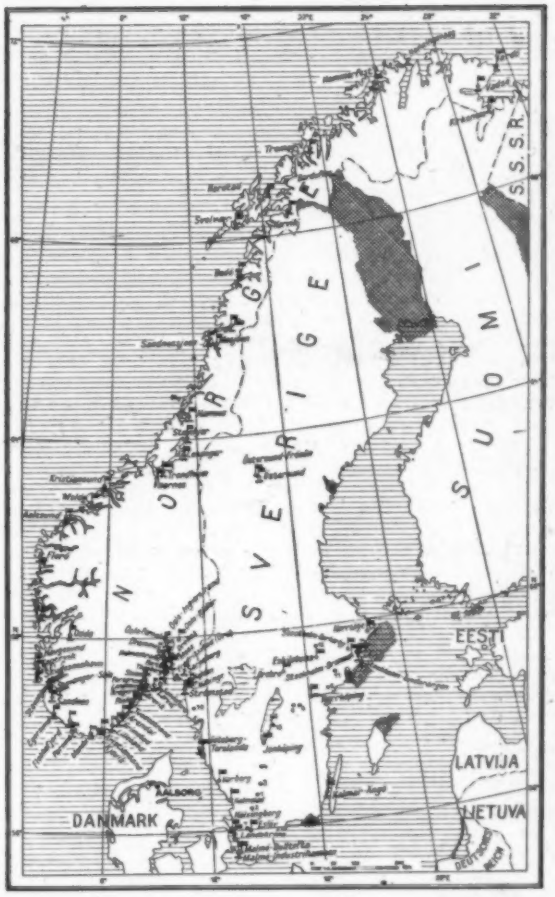
There are obvious difficulties about invading a country by sea when your Navy does not command the seas. Ships were prepared to carry the landing parties. News of this reached the Allies, but they could not guess which neutral was to be the next victim. The ships started, in some cases carrying troops disguised as civilians.

After they had started, the Allies took the decision of laying minefields at three points off the coast of Norway with the object of preventing the ships which had been regularly conveying iron ore from the Norwegian port of Narvik from making the whole trip to the Baltic under the protection of the neutral waters of Norway. That there was ample excuse for this technical breach of neutral rights will be generally agreed, but the point speedily became of small importance as Germany had already taken the preliminary steps to invade Norway—which was certainly no less a breach of neutral rights.

Small parties of German troops were landed at various points on the Norwegian coast, notably at Oslo, Kristiansand, Stavanger, Bergen, Trondhjem, and Narvik. Some parties of troops were hurried forward into Denmark and Norway by troop-carrying aircraft, doubtless to seize important points. There is the Junkers JU 52 which can carry a couple of dozen soldiers, and a four-engined one which can accommodate about 40 men. Supply ships followed to bring them munitions and other necessaries, and most of the German fleet came out into the open North Sea to try to protect the supply ships. It was a situation for which the Royal Navy, and likewise the Royal Air Force, had (so to speak) been praying.

At once the Home Fleet dashed towards the coast of Norway, where there were already strong contingents to cover our minelayers. The Bomber Command sent its squadrons into the air in numbers, and the Coastal Com-

WAR IN THE AIR (CONTINUED)



This map, reproduced from Interavia A.B.C., shows Norway to have a rather surprising number of aerodromes. Several are, however, unsuitable for large military aircraft. We have added on the map the aerodrome at Aalborg, Denmark, which may be used by the Germans for flying troops to various parts of Norway.

mand redoubled its always strenuous efforts. To find the German landing parties along such a coast as that of Norway would have been a lengthy business if only sea reconnaissance had been possible, and it was a case where air scouting became of the utmost value. It was not long before we knew pretty well all about the landing parties and could take appropriate action.

H.M.S. Gurkha Bombed

FIRST blood was drawn by the Norwegian coast batteries. Those in the Oslo fjord battered a German ship—one report said the cruiser *Blücher*, and another said the battle cruiser *Gneisenau*—and she was so hard hit by the short batteries that she drifted, probably out of control, on to some mines and was sunk. At Kristiansand a similar fate befell another cruiser. Bravo the Norwegian artillery!

Then naval and air activity blazed up along the Norwegian coast. On Monday, April 8, H.M.S. *Glowworm*, a destroyer, met first one and then two German destroyers, which she attacked. Then she saw another enemy ship to the North, and went after it. Evidently she ran into superior forces and was sunk, but she had shown the readiness of the Navy to engage the enemy wherever he is found.

On the Tuesday afternoon the Fleet was heavily attacked by German aircraft when cruising to the southward of the level of Bergen, and two cruisers were slightly damaged by splinters, but were not at all incapacitated and continued with the Fleet. One very heavy bomb hit the flagship, the battleship H.M.S. *Rodney*, but the deck armour, which has lately been provided for our battleships, was equal to the occasion and the vessel was not affected by the explosion. Three officers and seven men were injured by it. The extravagant German claims of successes in this action were all fabrications. The cruiser *Aurora* survived five successive bombing attacks without being hit, but the destroyer *Gurkha* (one of the famous "Tribal" class) was hit, and sank after four and a half hours. All but fifteen of her crew were saved. This, it is believed, is the first concrete success scored in this war by air bombs against a moving warship.

Earlier in the same day the battle cruiser *Renown* engaged the German battle cruiser

Newly loaded bomb racks form the centre of photographic interest at a Hampden station which sent machines to attack German warships off Bergen.

WAR IN THE AIR (CONTINUED)

Scharnhorst and the 10,000 ton *Hipper* (or one of her sister ships) and a stern chase at 24 knots took place in a heavy gale and snowstorm. The *Scharnhorst* was heavily damaged, but both the German cruisers escaped. The *Renown* was perforated by a shell which did not explode, but suffered no casualties.

On the Wednesday morning an epic sea fight took place in the Narvik Fjord. Five British destroyers steamed up and engaged six larger German destroyers supported by guns on the shore. The damage on both sides was heavy, our losses consisting of two destroyers while another was badly damaged; but the action achieved its object, as we sank all the six German supply ships in the fjord, and outside we blew up the ship which was bringing ammunition to the German troops on shore. On Saturday, April 13, the battleship *Warspite* led the British flotilla in again and sank all the seven destroyers in the fjord.

The Royal Air Force came prominently into the picture on Tuesday evening, April 9, and, of course, by the R.A.F. in this context we mean the Bomber Command. Two German cruisers and two destroyers had been located in Bergen Fjord (we must surely thank the Coastal Command for the tidings) and two waves of our bombers, twelve machines in each wave, went for them, attacking in line astern. In the failing light accurate observation was difficult, but one heavy bomb was seen to register a direct hit on the after part of a cruiser of the *Köln* class. The attacking formation of aircraft kept well above the clouds while crossing the North Sea. As the aircraft neared the Norwegian coast, the clouds thinned and eventually disappeared, thus preventing any surprise attack. The aircraft approached Bergen in full view of the enemy. Near the fjord two German cruisers and two destroyers were clearly visible, and within a few seconds the bombers were subjected to intense anti-aircraft fire. In the words of one bomb aimer: "One of the cruisers was particularly antagonistic and was singled out for attack. We climbed several thousand feet, circled above the ship, and then flew away, later turning back to make the normal approach before attacking. Several bombs were dropped, one of which hit the ship with a terrific explosion. The warship emitted volumes of black smoke and ceased to fire at us. When we first reached the fjord the cruiser was at anchor. Later, it moved about half a mile towards the main bay and then remained stationary."

The Turn of the Skuas

THEN the Fleet Air Arm took up the tale. Sixteen Skuas set off on the evening of Wednesday, the 10th, from the Orkneys for Bergen (some 350 miles) and made dive-bombing attacks on the second cruiser, going down in formations of three. They claimed three direct hits with 500 lb. bombs. Next morning the Coastal Command sent a machine over to inspect the results. In the place where that cruiser had been there was a patch of oil a mile long stretching the length of the jetty where the cruiser had been moored. The navigator said on his return: "Just before we set off at mid-day I was handed a photograph newly developed and taken by another of our aircraft earlier in the day. It showed all the shipping clustered in Bergen Fjord: the cruiser stood out quite clearly against the jetty, so I knew exactly where to look for it. We flew over the harbour at about 2,000 feet. The only trace left of the cruiser was oil. Just to make sure, we had a look in all the neighbouring fjords, but there was no cruiser anywhere near, and the anchorage where the cruiser was attacked by the bombers the previous night was empty. Bergen itself seemed a dead city. We saw no movement, except one or two tugs. No one seemed to take any notice of us. No anti-aircraft defence was encountered."

On Monday evening, April 8, the Germans made their fourth raid on Scapa Flow and lost five aircraft. On the Wednesday evening they made their fifth and heaviest raid on the Flow. No fewer than sixty aircraft arrived at dusk in successive waves without doing the slightest damage to the Fleet. Some bombs fell on the land, and a civilian was buried under debris, but only suffered from shock. The roof of a farmhouse was damaged by five H.E. bombs which fell near, and small fires were started in the heather by incendiary bombs—a very paltry result for so much expenditure of energy. But the German raiders did not only fail to achieve results. They suffered fairly heavy losses of at least eight bombers. Three of their machines were shot down by the A.A. guns and four or more fell to the fighters which went up to engage them. The fighters came from both the R.A.F. and the Fleet Air Arm. There was also a raid on a convoy near the Moray Firth in which two Heinkels, and probably a third German machine, were shot down by our fighters.

It was impossible to estimate the German losses accurately, as damaged machines fled from the fight but may not have reached home.

The crew of a Hampden which, with many others of its kind, co-operated with naval forces in attacking warships off Bergen. It will be noted that the Hampden's rear armament has been doubled. There are two Vickers K guns in each of the upper and lower positions.

When the serious nature of the attacks became known, the Commanding Officer of one fighter squadron, which was having a day off, decided to call his scattered pilots back to duty. He expected to have to collect them from golf links and other places in the neighbourhood. Instead, he found them sitting, waiting near their Hurricanes for fear of missing some of the war. This squadron, which has already destroyed five enemy raiders since the war began, went up and shot down another Heinkel. Three Hurricane pilots who brought down a raider off the Moray Firth intercepted their enemy when he was flying about a mile high. They immediately attacked. After each had fired a number of bursts the Heinkel crashed into the sea. A fighter pilot of another squadron saw one of the German airmen jump by parachute. He was picked up by a British destroyer. An hour later, three Hurricane pilots engaged a Heinkel bomber, which was flying more than two miles high, off the Banffshire coast. The fighters attacked immediately. The German pilot dived 13,500 feet with the Hurricanes on his tail, but eight good bursts of machine gun fire from the Hurricanes during their two-mile dive brought him crashing into the sea.

Torpedo-bombers at Work

ALTOGETHER in the days April 8, 9, 10 and 11, at least twenty German aircraft were shot down, while the R.A.F. had lost two flying boats, one reconnaissance machine, and three bombers in the same operations, and the Fleet Air Arm lost one Skua at Bergen.

Hitherto in this war torpedo-carrying aircraft had had no chance of proving their worth, for the lairs where the German warships were wont to lie up were outside the range of the torpedo-bomber squadrons of the Royal Air Force. But aircraft carriers can extend the range of an aircraft, and so the Fleet Air Arm decided to experiment with this form of attack. A standard class of carrier aircraft is the T.S.R., which stands for "torpedo-spotter-reconnaissance." The Fairey Swordfish is the usual T.S.R. A German cruiser of the *Hipper* class had been reported to be lying in the harbour of Trondhjem. At daybreak on Thursday, April 11, eighteen T.S.R. machines set off with torpedoes and high hopes. They found, however, that the cruiser had vanished in the night, but a destroyer was there and was duly torpedoed.

A Dornier flying boat was brought down in 35 seconds in the North Sea on Wednesday, April 10, by a Hudson reconnaissance aircraft belonging to the R.A.F. Coastal Command. The pilot of the Hudson made only one attack. He fired four bursts from his front gun while diving towards the Dornier, and one of its engines was immediately put out of commission. The Dornier plunged towards the sea, landed heavily, and began to sink. Only 35 seconds elapsed between the firing of the first shot and the time the Dornier struck the water. "A mighty quick piece of work" was how the navigator, a young Canadian from London, Ontario, described the incident. "We found the Dornier crossing our patrol and waited for him," he said. "His rear engine packed up straight away and down to the sea he went. He hit the water with a bump and went flopping and bumping along with one engine still running, like a wounded duck; then that engine stopped and we saw the flying boat sinking. The water was lapping over the gunner's cockpit. We watched the four men in the crew clamber into their orange-coloured dinghy and row away. We wirelessed their position to our base and pushed on with our patrol." An R.A.F. high-speed launch was sent out to try to find the survivors.

In an audacious bombing raid on Thursday night considerable damage was done to the air fields at Stavanger, in Norway. Numerous German fighter and bomber aeroplanes were wrecked by machine gun fire, and many of the staff and aircraft personnel were killed. The raid was carried out by Wellington bombers of the Coastal Command, accompanied by long-range fighters. The fighters, arriving at Stavanger first, dived upon the aerodrome, taking the enemy by surprise. They sprayed the aerodrome, aircraft and hangars with bullets before the anti-aircraft defences could be brought into action. Between them they seriously damaged three Junkers bombers and, it is estimated, killed or injured twenty of the personnel.

Half an hour later the Wellington bombers arrived. Approaching from the east they swept down on Stavanger in another surprise attack, dropping heavy bombs. Immediately, the bombers were met by intense, but inaccurate, anti-aircraft fire. Despite this they returned to the attack, machine-gunning enemy machine-gun posts, anti-aircraft batteries, hangars, and aircraft on the ground. Considerable damage was done and a great fire started. By this time many German fighter aircraft had reached the scene from neighbouring aerodromes and they attacked the raiders as they were about to return, their task completed. A fierce battle was waged, but only one of the British aircraft failed to return to its base.

Bomber Command aircraft were in action over the Baltic the same night and attacks were made on enemy ships over a wide area extending from Oslo Fjord in the north to the Baltic coast of Germany. One large vessel, apparently an ammunition ship, was hit by a heavy bomb and blown up; a line of eight to ten vessels was attacked in the narrow waters of the Great Belt; a 5,000-ton supply ship is believed to have been damaged, and bombing attacks were also made on a German seaplane base on the Baltic coast. The ammunition ship was one of a formation of eight grey-painted vessels which were seen steaming at high speed through the Great Belt, heading north.

"The night was pitch dark," said the captain of one of the British aircraft, "and at first there appeared to be very little traffic in the target area. Then we spotted a faint, small light bobbing on the dark surface of the water. It seemed worth investigation; so coming down low, we turned sharply towards it and released a parachute flare. The dazzling light made the sea almost as bright as day, and below us we saw about ten grey-coloured ships steaming north in company at about ten knots. Flaming onions and anti-aircraft fire came sailing up at us as we manœuvred into position and, with our target clearly illuminated by the slowly descending flares, we launched our attack. We dropped several bombs in quick succession, and it was the last to go that found the target. There was an almighty explosion, as if an ammunition store had been blown up or a boiler exploded. We were jerked about thirty feet upwards by the force of the explosion, and our tail gunner, when he had recovered his balance, reported that sparks of fire could be seen shooting out from the ship."

Surveying the Fjords

FIRED on incessantly by anti-aircraft batteries and repeatedly attacked, a Coastal Command aircraft carried out a lone and long survey of many miles of fjords and harbours in south-west Norway on Friday, April 12. The pilot set off from a Scottish base and, reaching the Norwegian coast, worked southwards, flying up and down every fjord he came to. Ships can only be seen from directly overhead in these fjords, so steep are the cliffs. The pilot, therefore, went up and down both sides of each fjord, travelling more than 300 miles to survey 50 miles of coastline. All the time, his crew were noting the shipping in the fjords, troop and transport disposition inland, and the tonnage and activities of every German merchant vessel and warship in the fjords. From the moment the Coastal Command aircraft reached the Norwegian coast it had to run a gauntlet of heavy fire for more than two hours.

Without deviating from course or compass, the aircraft pursued its patrol to the limit. The pilot had just completed his beat and was about to return to his base with valuable information when hidden machine-gun posts opened tremendous fire from one side of the last fjord, but only a few bullets struck. One came up through the floor near the navigator and another wounded the pilot in the head. He disregarded the wound and climbed into cloud to escape the torrent of bullets. Then the rear gunner shouted a warning that his starboard engine was losing oil. Realising that the engine might seize at any moment, the pilot decided to make the fullest use of his rapidly diminishing oil supply and only levelled out at 4,000ft. Then the damaged engine failed. The wounded pilot made for his base, and successfully completed a 350 miles sea crossing with one engine.

COMMERCIAL AVIATION

OFF TO LISBON. A Clipper leaves the seaplane base of La Guardia Field, New York, for its transatlantic flight. The incoming passengers will prefer this to Ellis Island.

BUSINESS NOT QUITE AS USUAL

"A. Viator" on the Difficulties of International Air Transport : Danish Machine Confiscated : K.L.M. and Sabena Carry On

LAST week was one of stirring events, even in the comparatively peaceful waters of civil aviation, where I am wont to bait my hook and cast mine angle. And, coo, lumme, chaps, what an angle on events in general and civil aviation in particular one sometimes gets!

Well, when the British Navy received that invitation to come to Norway's lovely fiords, and accepted, all civil aviation was stopped for a day, so far as neutral air lines were concerned, but happily the interruption was a brief one because many British and other passengers were stranded at both ends, and business looked like being badly interrupted.

But the authorities gave everyone concerned more than a fair show on this occasion, and the moment it was feasible, services were run once more, as far as Holland and Belgium, anyway.

Mind you, it has not been all ham rolls and honeysuckle running these lines for the past few days, and whilst the Commander of a neutral air liner may feel flattered at being afforded a salute of five or six guns when travelling exactly on his prescribed course, he is usually a modest kind of cove who would sooner have the cash value in the form of vouchers on the canteen at one or other of his terminal aerodromes.

There were all sorts of confused yarns flying around in civil aviation circles as well as elsewhere. Some said that a British Overseas Airway machine was trapped at Stavanger or Oslo, and there were several K.L.M. aircraft and crews at Oslo. One plane was said to have made a spectacular dash for Malmö through troubled skies, but I never really heard anything quite reliable about it.

Then there was the Danish machine and crew which remained over this side. It was treated as a prize, and whilst I do not believe a prize crew was put aboard, there certainly was a ceremony, though not, perhaps, so picturesque a ceremony as might have been staged. A duly authorised gentleman in a lounge suit and, I think, a bowler hat, climbed aboard and wrote a legend to the effect that the aeroplane was a prize of war, all over the place with a bit of chalk. Some solemnity and a faint official flavour were added to the proceedings by the circumstance that the bit of chalk was borrowed from H.M. Customs and Excise. So if they fail to make the usual hieroglyph on your handbag next time you travel by air you will know that this extra expenditure of the nation's chalk supply has caused a shortage.

Anyway, there is a spot of poetic justice in the fact that the machine thus collared is a Focke-Wulf Condor, made in Germany and purchased by the Danish company some time before the war. Quite a good commercial machine, too, and, incidentally, I believe, designed as a bomber.

The Danish crew, I am happy to say, will not be interned, and we may, I think, congratulate them on their good luck at being on this side when the trouble started. The service, which used to be run alternate days by the

Danish company and K.L.M. to and from Copenhagen, is now cancelled, but Holland is still served by several services daily, one of which is the Scandinavian Air Express, which, somewhat wisely, makes its terminus at Amsterdam these days.

A. B. Aerotransport, Sweden, is not operating at the moment of writing, so the Scandinavian Air Express is operated by K.L.M. Sabena is operating as usual, though by the time these lines get into print anything may have happened—or nothing.

As for the position of the Danish crew, as fine people as you could wish to meet, it is a trifle puzzling to us and to them. As a rule you are the bitter and declared enemy of invaders of your country, but what the Danish position really is completely baffles me.

Civil aviation certainly takes some hard knocks. I see that in the last week of March the K.L.M. and associated companies broke all wartime records for passenger and freight loads on the England-Holland-Scandinavia routes, when no fewer than 60 air liners flew between these countries, carrying 60 tons of freight and 600 passengers. All this toilsome building up of traffic disappears in the twinkling of an eye and will have to be painstakingly reconstructed later.

By the way, there was no stoppage of Air France and British Overseas Airways service to Paris; these carried on as usual.

Now that British Overseas Airways is properly in being, some enlightenment is due to scribes like myself as to what abbreviation the Corporation would prefer. I cannot go on writing the name in full, and I understand B.O.A. is frowned upon because it is too reminiscent of the gambols of a large and throttlesome type of serpent and B.O. has never been really popular in polite circles, as the Prince in the fairy story remarked to the Swineherd's daughter. So—if I may say so—what?

Regulations for neutral pilots and crews are strict when "ashore" in this country. The other day the pilot of a neutral air liner was due to return a couple of hours after his arrival, so to fill in time, the weather being fine, he asked permission to go for a walk. It was refused, though the same pilot, when stopping overnight, has the freedom of a small seaside town in the vicinity of the airport and may walk himself completely off his feet. In bowing to the decision that he might not take a walk, the pilot reflectively requested to know whether it would be to the detriment of Great Britain and Northern Ireland if he filled in time with a cup of tea and a cigarette in the restaurant. He was gratified but surprised when this permission was graciously accorded. A. VIATOR.

Bellanca Enters "Plastic" Field

THE Bellanca Aircraft Corporation is another firm to go in for construction of aircraft components out of plywood moulded to shape by heat and pressure and cemented with thermo-setting resins. It is reported to be applying the process in the construction of commercial aircraft.

Return from Lisbon

THE first survey flight on the new service to Lisbon was completed on Wednesday, April 10, when the De Havilland Albatross *Falcon* returned without incident. Sir Walford Selby, the British Ambassador at Lisbon, was aboard, and Mr. Bullitt, U.S. Ambassador at Paris, came as far as Bordeaux. He had just got off the Clipper at Lisbon and his return to Paris was very much expedited by the unexpected link by air to French territory. Mr. J. V. Wood, superintendent of European operations, also returned. *Falcon*, with the same crew as flew her out, left Cintra (Lisbon) at 8.26 G.M.T. and arrived at 17.15 G.M.T., an elapsed time of 8 hr. 49 min.

Trans-Canada Service to be Doubled

PLANS are going forward for increased service by Trans-Canada Air Lines. Four, instead of two, planes a day will cross the Dominion, to cater for the heavy spring business in passengers, mail and express which is forecast. To fill the positions of first officer and captain, 20 young Canadians are undergoing an intensive course of training. This will bring the flying personnel, exclusive of stewardesses, to a total of 80 by the summer.

THE INDUSTRY

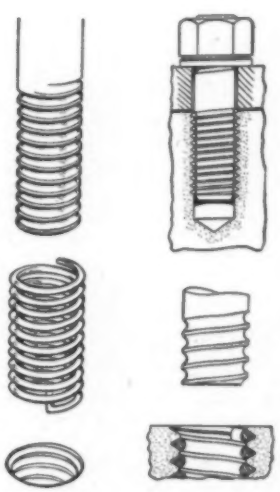
Two New Factory Products

THE explosive rivet and a device known as the Aero-Thread are two recent aircraft developments, the rights of which have been brought back to this country by Captain Edgar Percival, who has just returned after a five months trip to the eastern states of U.S.A.

Made by the Aircraft Screw Products Company, the Aero-Thread is a helically wound wire insert designed for use in bolt holes in light alloy. Its use enables a bolt of special thread form to be screwed into the insert and several advantages are immediately apparent from this combination. The thread on the bolt is rolled and round-bottomed, so that the surface is work-hardened, the root area greater, and the impact strength considerably increased by the absence of the "notching," which is inseparable from the V thread. Comparative test data on ⅜in. 16 threads per inch bolts of Aero-Thread and National Coarse forms are given as: Static tensile strength 19,400 and 17,900lb.; tensile impact, 141 and 65ft.-lb.

It will be seen at once that the insert, which can be made of bronze, steel or stainless-steel, is of such section that the bearing area between bolt and insert is smaller than between insert and the body of the light alloy metal. Such an arrangement allows the greatest possible advantage to be taken of a steel bolt screwed into light alloy, as the bearing strengths of the two materials are so vastly different. Also, when under load the insert can rotate slightly in the round-bottomed thread and so give as nearly uniform bearing pressure on the light alloy as possible, a very desirable characteristic when the moduli of elasticity differ as much as do those of steel and the light alloys.

The Aero-Thread is a considerable contribution to the maintenance problem as repeated screwings in and out cause no wear on the light alloy thread. If necessary, a new insert can be put in. Also, bolts with the round-bottom thread can be easily inspected by eye or an



Details of the Aero-Thread

ANSWERS

Below we give the answers to the Test Questions on Page 347.

1. Dornier Do 17.
2. Wiley Post, in July, 1933.
3. Greece.
4. R.E.8.
5. The ratio of the span to the mean chord of an aerofoil.
6. An aeroplane in which all the lift and also the propulsion is derived from the mechanical flapping of the wings.
7. Rotol constant-speed.
8. The resistance caused by roughness of surfaces in motion relative to the air.
9. Louis Paulhan on a Henry Farman biplane.
10. Yes. For the fuselage of the Vickers G.4/31 general-purpose biplane (1935).
11. 751.138 km./hr. (469.221 m.p.h.), by Fritz Wendel in a Messerschmitt.
12. Sopwith Camel.

The object illustrated is an aircraft ski.

"Flight" photograph.

GETTING TOGETHER. Alan S. Butler pays a flying visit to the Duke of Richmond at the new Hordern-Richmond factory.

electromagnetic crack detector, whereas such inspection on a V-threaded bolt would probably not show up a crack at the bottom of the thread.

The insert, which is of slightly greater diameter than the tapped hole, is screwed in by the use of a screw-driver type of tool with a slot engaging the end of the wire, which has been turned diametrically across the helix. The turning tends to contract the helix, which goes in remarkably smoothly. It cannot be unscrewed with the same tool as such action would expand the helix and make it grip the hole more tightly, but a very simple tool which grips the other end of the helix causes contraction and so extracts it. Its natural expansion in the hole gives it sufficient friction to prevent movement when the bolt is screwed in. When applied to holes for spark plugs, the system is claimed to give better conductivity and so to aid in cooling the plug.

The explosive rivet was originated at the Heinkel works in Germany, but has now been developed further by the Du Pont interests in America. Its advantages are obvious in all those places—and they are numerous—where holding-up is difficult. It is not necessary to get to both sides of the member being riveted, as "heading" is done by the explosion of a small charge in a hollow in the shank. In tubular members it can supplant the long rivet and the ferrule, both of which require a distance tube, and the attachment of skin is another place in which it should be very useful, particularly for putting on patches over bullet holes.

Its principal advantage over the pop rivet lies in its strength, for it is a solid rivet. The hollow part is almost entirely in the "head." The explosion, by its action, opens the rivet out against the plate and also tends to pull the plates together. Rivets are exploded by heat applied by an electric- or a benzine-heated "gun." The previous objection to the rivet, that the products of the explosion were corrosive, is stated to have been overcome.

The samples of riveting seen bore out the claim that uniformity of head shape had been attained. Whether uniformity of strength has also been attained is not known, as strength test data were not available. One sample showed three thicknesses of ¼in. steel plate riveted together by explosive rivets made of steel.

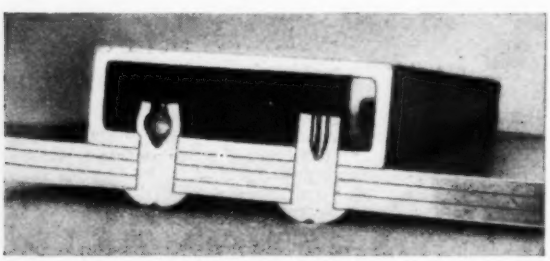
The method of filling each with the exact amount of explosive is ingenious. The rivets are placed, heads underneath, in holes in a plate whose thickness is exactly equal to the shank length. On top of this plate, another plate, with holes drilled to the same pattern, is placed, but with its holes displaced slightly. The explosive is then spread over the top plate and brushed in till the holes are full, any surplus being removed. The top plate is then moved till all the holes coincide and the explosive goes into each rivet shank. A coat of shellac, when dry, retains the charge.

Rivets are all dyed a distinctive colour to indicate length of shank and are supplied with various head shapes. The Civil Aeronautics Authority has been approached to give this rivet its approval in structural use as well as unstressed parts, but the decision is not yet known.

Capt. Percival holds the rights for these two devices and may be communicated with at 46, Upper Grosvenor Street, London, W.1, or Grosvenor 2895.

De Havilland and Hordern-Richmond

FLIGHT learns that the De Havilland Aircraft Co., Ltd., has acquired an interest in Hordern-Richmond Aircraft, Ltd. Mr. A. S. Butler, who is chairman of the De Havilland concern, will represent his company's interest on the Hordern-Richmond Board. The Duke of Richmond and Gordon with Edmund Hordern originally formed the company with the intention of producing aircraft of their own design, but as the time did not appear propitious, effort was concentrated on the production of wooden airscrews, with an eye on plastics and compressed woods for the same purpose at a later date.



An example of the explosive rivet.

They are fortunate in having with them Mr. Lang, whose experience of airscrew making goes back some 28 to 30 years, and also Mr. Tony Fletcher as chief designer, whose well-known ability is founded on many years valuable knowledge. A big factory is in the final stages of erection, and production should commence very shortly.

The Board and Management of Hordern-Richmond Aircraft, Ltd., as at present constituted is: Chairman, The Duke of Richmond and Gordon; Managing Director, E. G. Hordern; Directors, A. A. D. Lang, H. S. Kevill-Davies, C. Campbell, A. S. Butler, and C. D. Harrison; Chief Designer, A. A. Fletcher; Works Manager, A. J. Stevens; Secretary, W. J. Drummond.

THE INDUSTRY (CONTINUED)

Airspeed (1934), Ltd.

THE directors of Airspeed (1934), Ltd., announce that arrears of dividend on the preferred ordinary shares at the rate of 6 per cent. per annum, less tax, for the eighteen months ended December 31, 1937, will be paid on April 30, 1940, out of profits for the year ending July 31, 1940.

Drawing Service

GAVIN Starey Aviation Drawing Service, who have hitherto specialised in aviation publicity drawings and diagrams, have now extended their activities to include a full technical drawing service.

Their intention is to make available to the aircraft industry a concern where overflow drawing office work or instruction book illustrations will be handled by artists experienced in the presentation of engineering details. Their address is 28, Southampton Street, Strand, W.C.2.

Nickel News

THE current number of Monel Notes includes articles on the manufacture of Inconel exhaust manifolds, the hardening of K Monel and factors involved in the selecting of a spring material. This issue will no doubt interest the numerous firms who are now using Monel, Nickel and Inconel for the first time.

Copies are to be had from Henry Wiggin and Co., Ltd., Thames House, Millbank, London, S.W.1.

PUBLICATIONS RECEIVED

Brazing: Principles, Materials and Methods; 1s., Emmott and Co., Ltd., 31, King Street West, Manchester, 3.

Aeroplane Maintenance and Operation Series, Vol. I.: Carburettors (Part I), 5s.; Vol. II: Instruments (Part I), 5s.; Vol. III: Landing Legs, Wheels and Brakes, 5s.; Vol. IV: Airscrews (Part I), 5s.; George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

New and drastic Government restrictions upon paper which came into force this week, make it imperative for readers to place a definite order for FLIGHT. *In the future newsagents will only demand from the publisher those copies for which orders have been received.*